FACTORY MANAGEMENT and MAINTENANCE

DECEMBER, 1933

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Works Council—Yes or No?

H. P. Dutton
Associate Editor

ONE EFFECT of the now celebrated Clause 7 (a) of the Recovery Act has been to cause a general rush for works councils, company unions, or other devices for collective bargaining with employees. Some employers, in private, are quite frank in their expectation that, with the passage of the more acute phases of the present labor situation, their plans will be allowed to die a natural death. If the wish is father to the thought—which seems more than likely—these same employers will perhaps do well to reserve judgment until they have actually lived with a works council, say, long enough to give such a plan a fair trial. There is indeed more than a faint possibility that they will find it worth hanging onto as a permanent working tool of scientific management.

The Act specifies that no employee shall be denied the right to be represented in collective negotiations by representatives of his own choosing. There is nothing in the Act to prevent the individual employee, if he chooses, from dealing direct with management, as in the past, on questions of wages and working conditions. Machinery for collective bargaining is, therefore, not required by the Act, unless desired by the employees, and the setting up of such machinery is, unless the intent of the Act has been misunderstood, not necessary to comply with the requirements of the law. This purpose may be that which, in the past, has caused several hundred employers to form councils or employee associations, the desire to organize a genuine self-government by consent.

More probably, many of the plans now being set up are being established in the hope that the employee, finding available a mechanism for the expression of his desires, hopes, and complaints, will by that fact be deterred from being stampeded into joining or forming a trade union. This purpose is in itself a direct and sensible one. Conditions are not very conducive to calm thinking, and many employers have come to feel that at best, the craft organization of the trade unions, which cut squarely across the natural lines of industry interest, is a hampering and restrictive element, while at worst, in a few cases not fairly representative of the movement as a whole, the union has developed into a criminal racket.

With the details of the Chrysler plan (November, page 453) fresh in mind, management will want to know whether collective bargaining through some form of employee representation is a pink pill to be administered now as a pleasant sedative for restless labor, or whether it is going to be useful all-time management medicine

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See pages 519-20 for complete Goodrich plan

We may grant that the starting of some plan of collective bargaining through employee representation as a back fire to unionization is a sensible and legitimate step, provided it is not accompanied by forms of secret compulsion contrary to the spirit of the Act. But it may be questioned whether such a step is a wholly wise one, when it is undertaken with no deeper purpose than as a temporary expedient.

William Leiserson, in an address before the American Management Association in 1930, pointed out that plans for collective discussion and settlement of questions with employees have a way of growing beyond the original intent. You cannot lay a question of safety, or plant conditions, or the like on the table and say, "You are reasonable men, let us discuss this together," and then when one of these reasonable men brings up an even more pertinent question of wages or bonus or working conditions, say to him, "No, no, hands

off; *I* will settle that." Your agreement may erect a dozen fences around the sacred questions, but gradually, since these defences run contrary to common sense, management will either have to concede the point or in effect say, "We did not mean it."

What, then, is the premise that underlies the most successful of the non-union collective bargaining plans? That this premise is not merely the theorizing of "uplifters" is proved by the fact that it is advocated and defended by some of the largest businesses in the country, known for their hard-headed sticking to realities. Genuine collective bargaining, at first a rather doubtful experiment, has stuck with the larger corporations in this country. That is proof that the theory is sound, and pays financial as well as social returns.

The first representation plans were tried in this country as early as 1904 and 1907. The War found a few companies using such plans. The urgent needs of war-time production led to the installation under government pressure of many plans, some of which were abandoned as promptly as possible when the war ended. As with some plants in the present situation, they were alien additions forcibly grafted onto the business, not organic growths of a management philosophy. The National Industrial Conference Board[1] lists 145 plans in 1919, 385 in 1922, 421 in 1924, 432 in 1926, 399 in 1928 and 312 in 1932. The number of employees covered was slightly over a million and a half in 1928, slightly over a million and a quarter in 1932, indicating that most of the abandonments were among the smaller companies. Considering the very severe tests of the depression, the lowered morale, the reduced forces, it must be admitted that employee representation is one of the institutions emerging from the depression period stronger rather than weaker than it went in. Indeed, the testimony of one large company, a leading and long-time user of the plan, is to the effect that the council has been invaluable in sustaining morale and in ordering the organization for mutual self-help.

Courtesy of AMERICAN MACHINIST

However such plans may have been conceived and born, it is clear from the publicly and privately expressed opinions of those responsible for them that they are not now thought of primarily as negative or defensive measures.

There is a very real concern among some thoughtful manufacturers about the lack of interest of employees in their work. Elaborate, meticulous, and sometimes mysterious systems of wage incentives are developed at great cost which in theory ought to cause even the ice water in the factory coolers to circulate with a quicker pulse. Pep meetings are held, and notices are posted, rather in the "heavy father" style calling on employees out of loyalty for old General International, Incorporated, to refrain from throwing gum around the washrooms or lunch papers on the benches. But all the exasperated owner gets is a sheepish, half-hearted cheer when the eye of the foreman roves commandingly over the meeting, a half-hearted, suspicious caginess about the new rates. Undeterred, the management goes back to devise more ingenious formulas to attach more penalties and imperatives.

It is not to be wondered at that men who are often above the average in intelligence and good sense, and always feel themselves to be, fail to become enthusiastic over jobs in which there is no remote chance to use that intelligence. Smoothly functioning production requires precision and discipline, of course, and no practical man argues that every workman should do his work as the spirit moves him. But the works council represents an attempt, more or less clearly seen and effectively worked out, to restore to the worker some measure of that sense of control of his destiny which every normal man feels.

It is true that the worker is under orders, often very specific orders that tell him, "Move this hand first. Now

[1] *Collective Bargaining through Employee Representation*. National Industrial Conference Board, Inc., New York, 1933.

pull this lever. Now move this hand." But with an effective works council plan he has had, by proxy of his own choosing at least, a hand in determining these orders. The reasons for their necessity have been explained, and with greater or less success relayed back to him. He has an outlet for his grievances, a listener to his ideas. The petty grafts and tyrannies, endemic and perennial among the routine supervisors in all but the most exceptional of larger industries, are no longer wholly beyond appeal. A safety valve or lightning rod has been provided for the more dangerous of the emotional tensions which so often accumulate, unknown to the higher executives, until some small incident lets loose the sudden lightning of a strike.

Not very many workers nor many average citizens worry deeply or long about the processes of industrial or political government so long as these processes bring reasonably satisfactory results. Few workers are as much influenced to join labor unions by abstract consideration of the rights of fellow-workers to self-expression as by the hope that the union can get them a raise. The objection to the benevolent autocracies of industry, which prevailed in the past and are still maintained in many companies, probably comes less from the workers governed than from the student who is outside the picture. The worker accepts what he gets, if it is not too bad, and philosophically makes the best of it. The outside observer looks at the situation and sees what potentialities for productive effort lie unused, how clumsy a tool for arousing human energies is compulsion, as compared with the inner propulsion of an aroused interest.

- **Many of the plans are being established in the hope that the employee, finding available a mechanism for the expression of his desires, hopes, and complaints, will be deterred from being stampeded into joining or forming a trade union**

- **A lightning rod has been provided for the more dangerous of the emotional tensions which so often accumulate, unknown to the higher executives, until some small incident lets loose the sudden lightning of a strike**

- **Few workers are as much influenced to join labor unions by abstract consideration of the rights of fellow-workers to self-expression as by the hope that the union can get them a raise**

- **If labor is to be organized, it is better that the employer contribute constructively to the process than that he blindly nail his flag to the mast and buck the current of the times**

- **The actual thoughts and reactions of employees are very different from what some isolated and self-satisfied, if sincere, employers believe them to be**

No mechanism of management can of itself arouse this interest. Back of the mechanism must be a spirit, a purpose which makes itself felt to men who are quick to sense the lack of it. There must also be patience, for you do not change a heedless, day-dreaming clerk or a hopeless and inert clod of a shovel wielder into an Alger hero or an industrial statesman overnight. You never will change some of them, but steadily year after year, with a works council plan of employee representation, a selected fraction of the company's most substantial and dynamic employees will be sitting in a discussion which is inherently interesting and instructive, and which implies a flattering confidence in their responsibility and judgment. It would be strange if something of this broader understanding and quickening self-respect did not percolate down and lodge permanently in the ranks. Testimony is abundant that there is, indeed, a gain in interest and the development of a valuable cooperation and initiative in the shop which uses a works council plan with this purpose in mind.

A. J. Lupien[2], of Cheney Bros., distinguishes the following three phases in works council operation:

1. Management answers questions raised by the employee representatives.
2. Management presents educational material to be discussed by the employee representatives.
3. Management asks the employees to consider certain questions and bring in answers at some future date.

A reason commonly given for the abandonment of plans is that, after the passage of the first phase and the release of initial tension, the council occupied itself in trivialities. Such a reason is less a reflection on the plan than on the lack of understanding, foresight, or leadership at a period certain to come, when management must provide the leadership or at least bridge the gap until leadership develops among the men.

It is a safe bet that within a couple of years there will be a good many such abandonments of the present NRA crop of representation plans, with resultant injury to morale and loss of possible values.

There is another reason for some study of history and searching of motives before a plan is allowed to take shape. Times are changing. We are embarked under the President's leadership on a program that attempts to substitute some measure of coordinated, collective action for the destructive anarchy of unrestrained individualism. That program may fail, but all except the speculator who profits by disorder must hope that some program shall be found, and shall not fail.

An almost certain corollary of semi-governmental regulation by trade associations is that, in some organized way, labor will be heard in determining that regulation. Perhaps not the trade unions in their present form, for the unions, too, are on trial and must justify their utility. If labor is to be organized, it is better that the employer contribute constructively to the process than that he blindly nail his flag to the mast and buck the current of

(Continued on advertising page 30)

[2]See Employee Representation Technique, No. 49 of the American Management Association's "Production Executives' Series," Nov. 18, 1926, p. 4.

The Foreman Looks at Motion Study

Figure 1. Screw-plug and gasket assembly

and finds he doesn't have to wait for the time-study engineer

R. P. Foose

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A SHORT time ago, we attended a lecture on motion study, and on the way out one of a group of foremen remarked: "That's great stuff *for the time-study engineers.*" We had listened to a description of therbligs and how to identify them. We had viewed colored simo charts showing yards and yards of operations which had been reduced to as many feet. There were cyclegraphs, possibility charts, penerating screens, and an extremely interesting demonstration of an operation being taken by a micromotion camera. Yet the terse remark of the foreman aptly described the meeting —we had listened to an extremely descriptive lecture on micromotion technique for the time-study engineer. Great stuff for the other fellow but a little out of our line.

It remained for Dr. Lillian Gilbreth in an address before the Society of Industrial Engineers to strike the keynote to real progress in the development of motion study. *Motion study is also a function of the shop.* It can be applied in everyday shop practice. The foreman can, through a knowledge of its fundamental principles, effect numerous shortcuts in methods and savings. Quite frequently these savings can be realized long before the time-study man has an opportunity to get at the job. Even when the time-study man *does* develop the method it generally remains for the supervisor to put it into practice. To do this, it is essential that he have a thorough understanding of the basic rules applied in developing the method.

After the meeting, we were deluged with questions indicating a lusty desire to know more about the subject. The first step in our campaign, the creation of a "want to know" attitude, had been accomplished. The next step was the development of a teaching plan which would put the fundamentals of motion economy into everyday shop language.

To define motion study a plain, unadorned explanation was given. It is the study of the work involved in an operation or routine for the purpose of eliminating unnecessary time-consuming movements, reducing fatigue, and arriving at a best way to do the job for the particular conditions involved.

It was comparatively easy to develop explanations of the laws of motion economy which would present a picture of the thought and fix the principle firmly in mind. A few examples of these associative pictures are given to illustrate the point.

Since the most direct route from one point to another is along a straight line, the arrangement of parts to be worked on should be such that this principle is followed as closely as is practical. Generally, the material should be arranged radially around the operator at a distance approximating the length of his arm. In actual practice, the path followed will vary slightly from the straight line in order to create that effortless motion known as rhythm.

The champion sprinter or pole vaulter, when looked at in a slow-motion picture, demonstrates a smoothness and effortless flow of motion which approaches perfection as close as human training can make it. This is

45 Per Cent Saving on

OLD METHOD

	Left Hand	*Right Hand*
1.	Open vise	Grasp milled shaft
2.	Hold vise handle	Withdraw milled shaft
		Transport to box
		Release
3.	Hold vise handle	Transport empty to new shaft box
4.	Hold vise handle	Grasp unmilled shaft
		Transport to vise
5.	Close vise	Position shaft
6.	Transport empty to milling table lever	Idle
7.	Grasp	Idle
8.	Mill	Idle
9.	Return table	Idle
10.	Transport to vise handle	Transport to shaft
11.	Open vise	Grasp milled shaft

Total time in minutes .09*

rhythm of motion personified and is indicative of a high degree of skill. Skill in this case is the skill which comes through a close study of the best and least fatiguing movements, brought to perfection by practice in coordinating the mind and muscles. In other words, we transfer operator skill from a function of selection to that of length of training time. Rhythm is one of the major fundamentals and can be facilitated by the proper arrangement of jigs, fixtures, materials, or other tools. Frequent and sharp changes in the direction of motion break the rhythm, are therefore fatiguing and should be reduced to a minimum for best results.

We went back to a boyhood trick to picture the next principle. We are all familiar with the stunt of rubbing the stomach and patting the head. It is difficult primarily because it involves two distinct mental and physical actions. The mind must simultaneously motivate one hand to pat and the other to rub. If both hands pat, one thought creates the impulse which results in the movement of both hands with a corresponding saving in energy.

This example introduced another of Gilbreth's laws of motion—motions should be in opposite and symmetrical directions.

A division of work quite frequently simplifies the operation so that each operator performs fewer movements. Shorter cycles mean more repetitive movements, less thought required, and the development of an easier rhythmic habit cycle. The simplified method employs smaller muscle groups and therefore produces less fatigue. This law comes from the fact that the human body functions best and maintains its equilibrium or balance easiest when the hands and arms are moving in equal and opposite directions, or employing the corresponding muscle groups in the same manner. When this principle is applied, corresponding muscle groups are motivated by one thought instead of two, less concentration is required, and fatigue and energy losses are thereby reduced.

As mentioned before, the maximum value may be obtained from motion study when the supervisors have become motion-conscious by sufficiently mastering its principles. Being on the firing line, they can plan and develop changes in methods long before the time-study department has an opportunity to make the study. Many of our operations have been improved in this manner both by the shop supervision and by the employees themselves, some of whom have taken an intense interest in bettering their own work.

In a hand-milling operation of a flat on a quarter-inch shaft, the operator changed the method with no expenditure for changes in equipment or tools. The accompanying rough chart serves to indicate the old and the improved methods.

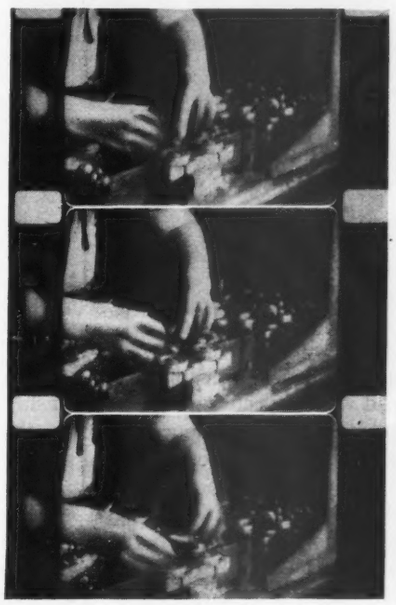

Figure 2. Roller-skate wheel assembly. Performed on a double jig. Each hand simultaneously assembles inner dust cap, wheel, outer dust cap, and axle bolt. Completed assemblies are ejected by foot onto a moving belt for next operation

It is obvious that a considerable saving could be accomplished by making the right hand work during the cutting time. Actually a reduction of 45 per cent was made. This reduction is indicative of the savings which can be made purely by rough methods. The use of the camera on this job might result in still greater savings, but the cost would probably nullify them.

Another interesting example involved the assembly of an insert, two gaskets, a screw plug, and a nut. The original method, when analyzed, showed considerable time being spent by the left hand in grasping the piece worked on. This is an almost universal fault and is quite frequently hard to rectify.

The first step was to develop an inexpensive foot-operated jig to free the left hand for more useful work. The pieces were conveniently arranged in a semicircle around the jig. The savings were very gratifying. However, it was not until increased production warranted a greater expenditure for tooling that the method was completely developed. The fundamental of equal and symmetrical motions was applied to the construction of a double jig. Now each hand assembles its own piece, with a 50 per cent saving and no sacrifice to quality. It may be well to state that we have never found it necessary to sacrifice our high standards of quality in order to make the new method work satisfactorily.

Inspection operations have also come in for considerable analysis and improvement, particularly where the inspection is combined with a partial assembly. For example, the insertion of a rubber gasket over a thread was combined with the inspection and gaging of the thread. A gage was placed over a hole cut into the bench. With the gage in this position, a hole in the

Hand-Milling Operation

NEW METHOD

Left Hand	*Right Hand*
1. Open vise	Grasp milled shaft with second and third fingers and withdraw
2. Idle	Insert new shaft being held in first and second fingers
3. Close vise	Transport milled shaft to box
4. Transport empty to milling table lever	Transport milled shaft to box
5. Grasp lever	Release milled shaft
6. Mill	Transport empty to new shaft box
7. Return table	Grasp new shaft by first and second fingers
8. Transport to vise handle	Transport to vise
Total time in minutes .05*	

*** Stop watch times were used as no smaller time breakdown was necessary.**

Figure 3. Assembly of threaded bushing and a force-fit washer. Note material bins in front and drop delivery chute behind two spindles. Both hands simultaneously assemble bushing and washer. Foot-operated press forces washer home

piece was cleared and gaged. Then with a half rotation of the piece the thread was inspected, the rubber washer inserted over it, and the whole dropped through the opening in the bench into a tool box. Savings were about 65 per cent.

Motion study may reflect itself in the design of dies and equipment. The die for a forming operation was so constructed that two pieces could be completed at each stroke. The material supply was arranged so that both hands could feed simultaneously into the feed slide, and air used to eject the pieces from the rear.

It is not necessary to think of motion economy from a shop standpoint only, as many savings can be effected if the same fundamentals are applied in the office routines. Departments having closely coordinated work may be placed together as closely as possible to reduce unnecessary walking back and forth and visiting tendencies. The arranging of furniture and equipment in an office will very often save valuable executive time. The mailing department with the aid of the time-study man has accomplished some excellent results. Circulars and pamphlets were arranged to facilitate insertion into mailing tubes, labeling, and stamping.

The purpose in describing the above examples and in illustrating one or two others (see Figures 2 and 3) is to indicate some of the results which may be expected through the application of motion study. We realize that quite frequently our set-ups are not letter perfect and that micromotion camera studies would still indicate ways of improvement. There is no question that instruments of this nature have numerous applications, particularly in larger organizations, and excellent results have been accomplished with their use. However, we feel that in a smaller organization it is possible to get satisfactory results purely through the instruction of the supervisors and personnel in the fundamental laws of motion economy. *The controlling factor in any work of a cost reduction nature must be good common sense in large doses.* The law of diminishing returns holds good throughout this work. If 80 per cent of the savings can be accomplished with a small expenditure of money for tooling and equipment, requests for additional expenditures must be scrutinized very carefully to return to a profit on the remaining 20 per cent.

There is also grave danger of creating a negative reaction to motion study by premature discussions of its extremely technical phases and through the too-hurried use of cameras, simo charts, and other refinements. It is better to go slowly and progress rather than to spend too much energy trying to overcome resistance. Space does not permit a discussion of the steps developed and used in selling and teaching the new method. However, the success or failure of an otherwise perfect operation may depend solely on this phase, indicating that its importance cannot be stressed too greatly.

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Magna Charta for Industry Says NRA Official

NEW TRADE associations or old ones with new leaders are writing into their codes the elimination of those vicious trade practices which the ablest men in industry have been striving to bring about for years. These leaders have also recognized in recent years that the elimination of costly, unsound trade practices must be accompanied by some method of stabilization of employment and a more equitable distribution of earnings, if there is to be any permanency of prosperity itself.

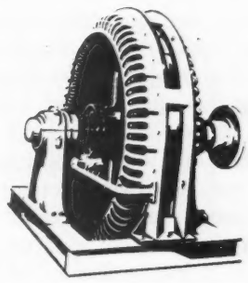
This is the essence of NRA: It is the great opportunity for which business leaders have been asking. When the early wave of popularity of NRA is forgotten and the pain of over-optimistic hopes never realized, is gone, I believe history will record this Act as the Magna Charta of modern enlightened business conduct under a better balanced capitalistic system.

Remember, however, that the degree to which my prediction will come true, depends on the unselfish attitude of this all-important triumvirate—management, labor, and government.

While the first phase of NRA, which is the codification of industry, is not complete, the end is in sight. A large majority of workers employed, it is estimated, will be under codes within the next two months. . . . The all-absorbing topic of interest to industry and the public at large is the administering of these codes, the degree of government control which will be exercised, and the extent of industry self-regulation to be permitted.

From the address of Malcolm Muir, Division Administrator, National Recovery Administration, and President, McGraw-Hill Publishing Company, before the American Arbitration Association, New York, Nov. 14, 1933.

Principal Developments in Electric Motors



In preceding articles Plant Service, Mechanical Power Transmission, Electrical Control, and Electrical Distribution Equipment have been discussed

Direct-Current Motors

Improvements in design have for the most part related to the mechanical rather than electrical features, although the latter have not been neglected. One interesting development has been the introduction of a line of motors so designed that many variations, such as different degrees of inclosure for various applications, can be made by the use of only a few different parts. Among the features of this new line are a new type of pulley-end shield, drop-forged feet which are welded to the frame, and insulation which is resistant to moisture and weak acids.

Of interest as showing the range of speed obtainable with direct-current motors is the development of a special design for machine tool application, where tungsten-carbide tools are used at high speed. Rated 50 hp., intermittent, this motor has a speed range of 450 to 3,600 r.p.m., 8 to 1 ratio, by field control.

Some refinements have been made in the regulation of electroplating generators, which are low-voltage, direct-current machines. In one type now available the voltage may be set for any required drop, for a constant no-load to full-load voltage, or for an increasing voltage on increasing load. The generator is separately excited, and the compensating effect is produced at all voltages within the operating limit of the machine. Compensator circuit and generator field circuit are separately adjustable, neither affecting the proper functioning of the other.

A feature of one small-sized, direct-current motor on the market is the refillable commutator. If the copper bars become damaged or badly worn, they may be removed and replaced.

Operation of direct-current motors has been bettered through improvements made in carbon brushes. Research on carbon and graphite has made possible the production of brushes having almost any desired combination of physical characteristics, such as hardness, resistance, and abrasiveness.

Alternating-Current Motors

The most important development affecting the electrical characteristics of alternating-current motors has been the inclusion of a static condenser or capacitor as an integral part of the motor. More widely applied to single-phase motors at first, the use of in-built capacitors has been extended to polyphase machines. Advantages of the capacitor design are operation at power factor approaching unity, higher starting torque, lower starting current, increased efficiency, and higher full-load speed.

During the past several years the field of application for synchronous motors has steadily expanded, largely in consequence of improvements in operating characteristics, so that they are now being applied in many cases where exceptionally high starting, pull-in, and pull-out torques are involved, and where formerly their use would not have been considered.

Synchronous motors in sizes from 10 to 10,000 hp. have been made available with nutless, boltless, and threadless stators. The stator cores are built up in such a way that the whole unit can be welded into a rigid, permanently tight structure.

Demand for motors having long life and low maintenance cost under severe atmospheric conditions has resulted in the extensive development of explosion-proof, splash-proof, dust-tight, and similarly protected motors. In hazardous locations, such as encountered in oil refineries, dry cleaning, paint and lacquer plants, and so on, the explosion-proof type of motor need not be installed in a fireproof vault, from which the equipment is driven by extended shafts. Mechanical design of explosion-proof motors has been simplified, better methods of inclosure used, and protection of leads greatly improved.

Splash-proof motors have been developed for dairies, packing houses, breweries, paper mills, canneries, boiler rooms, and the like. In a new motor of this kind now available, baffles in the air passages prevent entrance of water splashed with considerable pressure from any angle; nevertheless this motor is adequately ventilated and is built in the same dimensions as standard open motors. Use of such a motor eliminates the need of the special steel cover that would usually be required to protect an open-type motor subject to splashing or dripping of water, and it is less expensive than a totally inclosed, fan-cooled motor.

In another drip-proof motor shrouded fans inside the end bracket serve to discharge through a vent at the bottom of the inclosing jacket any water than enters. Such protected motors are available in all commercial speeds, frequencies, and voltages.

A line of synchronous motors in the totally inclosed, fan-cooled type that has been designed particularly for

use in explosive-gas locations has been made available. Heavy cast-iron frames and end shields, with long, close fits around the rotating parts and wide machined joints, are used to withstand the pressure produced by internal explosions, and provide for cooling of the flames. Collector rings are separately inclosed in a cast-iron housing mounted opposite the coupling end. Cooling of these motors is accomplished by a fan mounted within the end shield at the coupling end, but external to the main inclosure.

At least one installation has been made of totally inclosed, fan-cooled synchronous motors that embodies unusual features made necessary in order to meet conditions in the plant of a large oil company. Because of exposure to highly flammable gas, it was essential to inclose the motors, but the size and nature of the installation precluded the use of the usual explosion-proof construction, and forced ventilation was not considered practicable. To accomplish the desired end the motors were totally inclosed and filled with carbon dioxide gas under an internal pressure of approximately 2 in. of water, so that any leakage would be outward. Cooling air is directed over the frame by an external fan and outer inclosure.

A screenless open motor, designed for operation in extremely dusty conditions, or where the atmosphere is heavily laden with floating particles of lint, as in textile mills, is now available. Air passages have been constructed so that as soon as the lint enters the motor it is blown out. Smooth, glossy windings keep it from adhering. There are no pockets or recesses in the frame near the winding. Bearing housings are dust- and oil-tight.

To meet conditions in the oil industry, where the rate at which wells are pumped may vary suddenly and over a wide range, a triple-rated, drip-proof motor has been developed. It is designed to deliver 9, 16, or 25 hp., all at the high efficiency of full-load rating and all at the same speed. Change in output is accomplished by the use of three connections of the stator winding—delta, star-delta, and star.

Small motors that can be stalled on the line for an indefinite period, without injury to the winding, are now on the market. Heretofore motors have been protected against overheating from overload or stalling by external relays of one type or another. In the new motor a simple thermostat is built into, or attached to, the motor in various positions, depending on the size and type. If for any reason the temperature rises to an unsafe value, the thermostat operates to open the coil circuit of the starter, or give an audible or visible signal through a bell or warning light.

One line of squirrel-cage motors that has been developed is distinguished by easily separable electrical and mechanical parts, in order to facilitate repairs and reduce maintenance costs. The stator core and winding are pressed into the frame and can be removed as a unit, so that if electrical trouble develops in the winding the core can be removed and a spare inserted within a short time. The defective core can then be rewound at leisure, or returned to the factory. The construction of these motors makes it possible to supply different types of frames to fit various needs or conditions.

Rapid-reversing squirrel-cage motors, capable of making up to 60 reversals a minute, continuously, without overheating, have been developed. They are characterized by light-weight rotor construction, efficient ventilation, high torque characteristics, and shock-resisting cast-iron frames, and are designed for use on such machines as tappers, threading machines, broaches, planers, slotters, and millers.

Motor bases designed to absorb vibration and prevent its transmission to the building structure have been developed. For many years motors used in public buildings, and sometimes factory installations, have frequently been mounted on some form of insulated base to reduce noise, but the expedients employed usually left something to be desired. The new bases make use of a special insulating medium under heavy stress. They are intended for application only with multiple V-belt drives up to 50-hp. rating. Provision is made for belt adjustment through a sliding feature.

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Used Equipment Practice

NO INDUSTRY is without its quota of used equipment. How will it fit into the recovery program? What shall be fair practice in selling it?

That answers to these questions are on the way is indicated by the formation recently of the National Institute of Used Machinery and Equipment dealers. The intention is to include eventually dealers in all classes of used equipment. M. D. Galbreath, President of Marr-Galbreath Company, was elected president. Dealers from St. Louis, Chicago, Detroit, Pittsburgh, Philadelphia, and New York, attended the meeting.

Executive offices are to be located in Pittsburgh.

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Textile Equipment Regulation

A REGULATION adopted by the Cotton Textile Industry Committee and approved by the National Recovery Administration provides that:

1. Manufacturers shall register with the Cotton Textile Institute an inventory of their productive machinery in place on Oct. 1, or then under contract but not installed.

2. Manufacturers, commencing Nov. 1, shall file monthly reports with the Institute showing installation of additional productive machinery (new or second-hand) and specifying the extent to which such installation is for replacement of similar number of units, or to bring operation of existing machinery into balance.

3. Commencing Oct. 1 prior to installation of additional productive machinery not theretofore contracted for, except for replacement or balancing, manufacturers shall file application with the Institute, stating reasons for such installation—and secure from NRA, through the industry committee, a statement that such installation will be consistent with effectuating the policy of the act.

4. The industry committee shall examine the application and the facts, and make its recommendations to NRA as to granting or withholding the certificate.

Know These Safety Guards?

Safety programs begin, never end, with mechanical guards. There are plenty of other positive "guards" which, because they add to the ease, contentment, and well-being of employees, are equally valuable in accident prevention work

WHAT we once thought was the solution of the entire problem of accident prevention—namely, the mechanical guard—is but a small part, while other preventives, some most odd, already play or are commencing to play their part. Among them may be included minimum labor turnover, good health, contentment, neatness, cleanliness, English language, good lighting, wearing apparel, education, X-ray apparatus, air conditioning equipment, and photo-electric cells.

Who is there will deny that light, besides enabling work to be better seen and done, hazards observed, and accidents therefore avoided, also adds cheer to a place; that neatness and cleanliness, involving the removal of dirt and obstructions, produce a feeling of comfort among the workers; that safe working conditions relieve or avoid mental strain; that good health is a distinct asset to every worker?

If we accept the tabulated statements of five states for one year as published in *Accident Facts,* 1933 edition, of the National Safety Council, as being typical of the entire country, then accidents in the industries may be divided into the following classes:

	Number	*Per Cent*
Handling objects	58,249	25.9
Falls to a different level	19,616	18.2
Falls to the same level	21,426	
Machinery	26,884	11.7
Vehicles	24,569	10.9
Falling objects	19,572	8.7
Using hand tools	17,050	7.5
Stepping on or striking objects	12,552	5.5
Electricity, explosions, heat	8,021	3.5
Harmful substances	4,607	2.5
Other	12,115	5.3
Total	224,661	99.7

It is seen that handling objects constitutes by far the largest single cause of industrial accidents—and curiously they are accidents away from machines.

This would seem to indicate, therefore, that mechanical handling should be substituted as much as possible for handling by hand. Among the most important safety devices for this work should, therefore, be listed mechanical feeding, conveyors, trucks, cranes, hoists, and the like. Sometimes a rerouting of material through the manufacturing departments or a change in the sequence of operations may reduce the amount of handling; occasionally it is gloves or wearing apparel that cause the accident, and even the not wearing of them.

The next largest item is falls, and another group of safety devices is indicated as being the solution for a large percentage of them—namely, ladders, railings, platforms, plant cleanliness, neatness, and good lighting.

Of the accidents due to falling objects, the wearing of safety shoes would probably have prevented fewer reportable accidents, even if not removing the causes, and there is no reason why safety shoes should not become the universally worn shoes instead of being simply special to the industries.

Railings, toe boards, and rims to floors, benches, and platforms, as well as proper stocking, would also reduce the total of accidents due to falling objects.

A goodly number of accidents due to hand tools would undoubtedly be avoided by the elimination of mushroomed and other defective tools generally, by the use of the right tools and in the proper condition, by the wearing of goggles, and by various screens. Perhaps manufacturers of goggles may be able to develop a single type—light, comfortable, and large enough to be worn over prescription glasses—in other words, a more nearly universal type, capable of being fitted with side bows or elastic bands, thus giving a further impetus to the use of goggles.

Taking up next accidents due to machinery, it is a fact that, although many accidents are due to machinery, we continue to urge the further use of machinery to reduce accidents, as indicated by the recommendations under accidents due to handling objects. Engineering revision, too, may be counted on year by year to assist in this work by the production of foolproof designs.

As for accidents due to harmful substances—a not inconsiderable number—some improvement may be made in this direction by the more extended use of cautions on the containers of such substances and on the specifications from which they are ordered, as well as on the process specifications calling for their use in course of manufacture.

Electricity and automobiles have come into such general use that education in the proper handling of

From an address by C. B. Auel, Manager, Employees' Service, Westinghouse Electric & Manufacturing Co., presented before the National Safety Council, Oct. 3, 1933.

Impossible for the operator to get his hands under this press. Pieces are fed through a chute, travel around the die into position. Punchings are automatically discharged through the chute at the right

A simple guard this, but one which, because of its very simplicity, is the more often overlooked. It protects workers against sharp corners

them offers the best solution for the reduction of accidents from these causes.

However, in our plant we physically examine at regular intervals all of our men, from designing engineers to wiremen, if at any time their work involves handling live circuits, regardless of voltage, for we have found that over the years several of our men have succumbed to shocks which, had they been in normal physical condition, would hardly have caused disability or would at least have responded to the prone-pressure method of resuscitation. Members of our fire department are also included.

Brief reference has already been made to lighting, but it is of such importance, having as it does an influence on so many of the causes of accident mentioned here, that further reference to it is warranted.

Dr. LeGrand H. Hardy, Director of Eye Service in the Fifth Avenue Hospital, New York City, has stated that of 50,000,000 incandescent lamps installed in our industrial plants, less than 25 per cent are so installed that that will not produce glare. He makes the further statement that 15 per cent of industrial accidents are caused by poor lighting, with an annual direct cost to employers of $150,000,000.

How much of this is due either in whole or in part to defects in workers' vision is not possible to state, but it must be appreciable since estimates indicate that 40 per cent of the industrial workers suffer from poor vision.

Good lighting, however, is exceedingly cheap, for it can be shown in an interesting way that if a worker increases his output by only two to three minutes per day, either due to better vision, fewer delays, or less spoilage, the cost of good lighting will pay for itself.

Notwithstanding the greatest diversity of signs pertaining to safety already on the market, a further wide application for these may be found. It is suggested that they be used to enroll workers for various purposes—those who have never had an accident; those who have gone five years without an accident—giving to each a high-grade sign and fastening it to his machine in a prominent place or placing it on a standard at his work bench. A plan we have adopted in our own plants has been to list occupations or jobs at which goggles should be worn, then to provide each worker who promises to campaign in our drive against eye accidents with a handsome sign of suitable size for his machine or work bench, and with the wording: "Eyes protected on this job—operator wears goggles."

Notwithstanding all of the progress made in the prevention of accidents (through the development of safety devices and standards, as well as by educational methods), an increase, even small, in the standard of health over the country would do more than any other one thing to reduce accidents; and, as byproducts of such increase, would go many of the "isms" to which the flesh is heir.

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Better Than Compensation

E. L. HASKINS

PUT ME down for an old viewer with alarm, if you like, but *accidents are increasing in number.* Don't take my word for it. Read a report of the Industrial Commission of Ohio, Division of Safety and Hygiene, dated November 9:

"There were 94 claims for fatal injuries filed with the Industrial Commission in September, or 7 more than the month before and 26 more than in September, 1932. . . . Lost time, 751,164 days, or 51,409 more than the month before and 174,754 more than in September, 1932."

You see? It's the same thing that always happens with sudden increases in employment. The only difference is that this time it is going to be a lot worse than usual.

Here's why. First, men who are idle for months and months lose their skill. They just get rusty. Plenty aren't going back to their old jobs, but are tackling new ones. Plenty more, don't forget, have actually been hungry, are run down, have lost some of their old alertness.

Now the Ohio Industrial Commission has a sort of slogan: "Safety is better than compensation." I like it, and I like to think that right now, when more business means more hazards, is the time for every industrial concern to make its plant a safer place to work in.

I even offer a few suggestions: (1) Be sure to pick new employees right; (2) teach them how to work efficiently and safely; (3) make it hard for them to get hurt by installing proper guards and by putting and keeping equipment in A1 shape; (4) keep the plant in apple-pie order; (5) set up a safety program.

Kellogg's Security Plan

A logical complement to the six-hour day* and, like it, designed to assure the maintenance of purchasing power which is essential if the output of industry is to find customers

W. K. Kellogg

Discontinuance of Old Plans

The present Group Life Plan and the benefits under the Kellogg Cooperative Aid Society will be discontinued as of September 30, 1933, and the new Plan will become effective on October 1, 1933, provided 75 per cent of all eligible employees have then subscribed.†

The present benefits under the Life Insurance and under the Kellogg Cooperative Aid Society will be (in accordance with limitations) continued for any employee now covered under these Plans and who is absent from work on October 1, 1933, until he is eligible to join the new Plan.

Administration of the New Plan

The Retirement and Sickness and Accident benefits under the Plan will be underwritten by the Metropolitan Life Insurance Company, and the Life Insurance will be underwritten by the Travelers Insurance Company.

Eligibility

All present employees with at least three months of service may join the Plan on the effective date, if then actively at work.

Other present and new employees may join on the first of the month next following completion of three months of service, if then actively at work.

An employee absent from work when otherwise eligible may join on the next first day of the month on which he is actively at work.

Life Insurance and Death Benefit

In the event of your death, while insured under this Plan, from either natural or accidental cause, the Life Insurance will be payable to the beneficiary named by you.

If, while you are insured, you qualify under the policy provisions for Total and Permanent Disability benefits prior to age 60, the amount of your insurance will be paid to you in installments.

In addition to the Life Insurance, your beneficiary will receive all of your contributions toward retirement income if death occurs before retirement income payments begin. If death occurs after retirement, any excess in your total contributions toward retirement income over the total amount of retirement income you have received will be paid to your beneficiary.

SCHEDULE OF BENEFITS AND CONTRIBUTIONS

Life Insurance	Weekly Sickness and Accident Benefits	Monthly Rate of Retirement Income for Each Completed Year of Service as Contributor	Your Weekly Contributions (50 Times per Year)	
			For Insurance Benefits	For Retirement Income (100 Per Cent Returnable in Event of Withdrawal or Death Before Retirement)
Men..... $1,000	$12*	$1.50	$0.45	$0.70
Women..... 1,000	9*	1.00	.35	.45

*Provided, however, that in no case shall any individual employee be covered for an amount of Weekly Sickness and Accident benefit in excess of two-thirds of his weekly earnings, such amount of Weekly Sickness and Accident benefit to be taken to the next higher even dollar.

Weekly Sickness and Accident Benefits

Weekly benefits will be payable to you in case you become totally disabled and are under the care of a licensed practising physician and are unable to work because of

(a) Any sickness for which you are not paid benefits under any compensation law or act; or *(b)* Any accident occurring while you are not working for wage or profit.

Sickness benefits are payable commencing with the fourth day of disability, and accident benefits commencing with the first day of disability. Payments will continue during the period of disability for a maximum of thirteen weeks for any disability due to the same cause, whether the period of disability is either continuous or intermittent.

Benefits for disabilities due to different and unrelated causes will be payable as often as they occur, except that for employees over age 60 benefits for sickness are limited to a total of thirteen weeks during any twelve consecutive months.

These benefits are not available to employees receiving retirement income or to employees 70 years of age or over, and, in the case of insured employees, will be terminated when retirement income begins or on the anniversary of the policy following attainment of age 70, whichever occurs first.

Retirement Income

A monthly income will be payable to you for life commencing with the date on which you retire.

Normally your retirement date is the anniversary of

*Adopted December 1, 1930, by the Kellogg Company, Battle Creek, Mich. (See *Factory and Industrial Management*, December, 1930, p. 1148A; May, 1931, p. 775; October, 1931, p.54; April, 1932, p. 157.)

†Accepted at a meeting of Kellogg employees, foremen, and executives, and put into effect October 1, 1933.

joining the Plan nearest the 68th birthday for men and nearest the 65th birthday for women. If you are now past that birthday, your normal retirement date is the effective date of the Plan. With the consent of the Company you may retire before or after your normal retirement date.

In case of earlier retirement, you will receive a smaller income than you would have received had you remained active until your normal retirement date. In case of later retirement, your contributions toward retirement income will cease at your normal retirement date, and your retirement income will not increase.

At retirement, the Life Insurance will be reduced to $500 and carried by the Company without cost to the retired employee. This also applies to employees who are now receiving or have received pension benefits.

THE COMPANY PAYS THE BALANCE OF THE ENTIRE NET COST OF ALL OF THE ABOVE BENEFITS. [Employee contributions for old age retirement will be more than matched dollar for dollar by the Company.—Ed.]

Retirement Income for Past Service

For the benefit of older employees whose membership in the Plan from date of entry until retirement will not provide an adequate retirement income, the Kellogg Company will see to it that no present man employee who joins the Plan when first eligible to do so retires at normal retirement date with less than $25 a month, and that no present woman employee who joins the Plan when first eligible to do so retires at normal retirement date with less than $20 a month retirement income.

Widow's or Dependent's Option

You may avail yourself of either of the two following options:

(a) You may elect to receive a reduced amount of retirement income with the understanding that the payments will be continued to a surviving dependent for the balance of the dependent's lifetime. If this option is elected within five years before normal retirement date, evidence of your good health may be required by the insurance company.

(b) You may elect to receive a reduced retirement income with the understanding that 50 per cent of this adjusted amount will be continued to your widow or widower for the balance of his or her life. This option may be elected without medical examination any time prior to one month before normal retirement date.

In either case the amount of the retirement income depends upon the age and sex of your dependent. Under either option, if either you or your dependent dies before retirement, the option will become inoperative.

Withdrawal from Service

If you withdraw from the Plan any time prior to your normal retirement date, you have three options as follows:

1. You may have in cash all of your contributions toward retirement income.

2. You may continue your retirement income contributions to the Metropolitan on an annual basis and receive a monthly income payable for life from your normal retirement date, as provided by the total amount of your retirement income contributions.

3. You may leave your retirement income contributions with the Metropolitan and receive a monthly income payable for life from your normal retirement date, as provided by your retirement income contributions up to date of withdrawal.

If an insured employee leaves the service for any reason prior to retirement, he may arrange to convert his Life Insurance into any of the regular life insurance policies customarily issued by the Travelers (term insurance excepted) at the rate applicable to his attained age and class of risk. He may do so without medical examination, provided application is made within 31 days after leaving the service.

Change of Beneficiary

You may change your beneficiary under the Life Insurance and under the death benefit at any time, upon written request on forms provided by the insurance companies.

Certificates

As a participant in the Plan, you will receive a Certificate from the Travelers outlining your rights and privileges under the Life Insurance provisions of the Plan, and also a Certificate from the Metropolitan outlining your rights and privileges under the Retirement and Sickness and Accident provisions of the Plan.

Effective Date

The Retirement and Sickness and Accident benefits, as well as the revision of the Life Insurance benefits, will be effective on October 1, 1933, provided at least 75 per cent of the eligible employees have then subscribed.

No Medical Examination

If you make application when first eligible, no medical examination is required. However, if you do not make application promptly, you will be required to pass a satisfactory medical examination at your own expense in order to join the Plan later. New employees, after becoming eligible, will be allowed 31 days to make application without medical examination.

Nursing Service

The Kellogg Company's Social Worker will continue her visiting nurse work.

The Metropolitan also maintains a visiting nurse service in Battle Creek, Albion, and Sturgis, which will be available to all members of this Plan who live in these towns. If you are sick or injured, a nurse will call at your home, if desired, and will continue to visit you if you have a doctor in attendance.

Health Literature

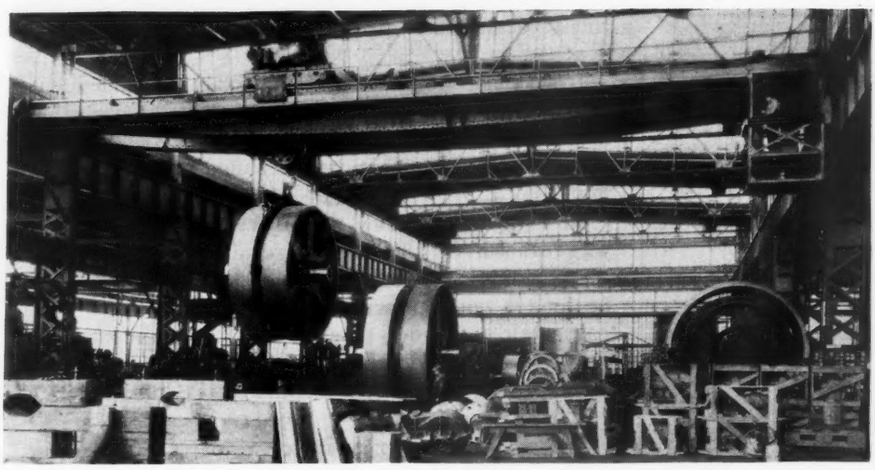
The Metropolitan publishes booklets on health conservation, disease prevention, hygiene, and so forth. In conjunction with this Plan, these booklets will be distributed to you from time to time, without cost.

In Event of Change or Discontinuance

The Kellogg Company hopes and expects to continue this Plan into the indefinite future, but necessarily reserves the right to change or discontinue it at any time. However, one of the strongest features of the Plan is that any change or discontinuance *cannot affect the retirement income secured by your own contributions and those of the Company which were made prior to the date of such change or discontinuance.*

Examples of Total Retirement Income

1. A man entering the Plan at age 30 would receive at age 68:
   38 × $1.50 per month, or $57 a month
   or $684 a year FOR LIFE.
2. A woman entering the Plan at age 25 would receive at age 65:
   40 × $1.00 per month, or $40 a month
   or $480 a year FOR LIFE.



Does Your Production Wait on Cranes?

This copper refinery finds it pays to place cranes and runways on rigid maintenance schedules with a single crew to handle both electrical and mechanical repairs. Result—repair costs a third less, production delays far more infrequent

Eustace H. Thompson
Consulting Engineer, Baltimore

CRANE service in a metallurgical plant had become decidedly unsatisfactory after several years of low production, with the consequent easing up on repair work. When the 34 cranes were then called upon to handle a larger output, it became highly necessary to re-organize the personnel and find better ways to control operations and repairs.

A general costkeeping system was just then being installed with the special object of helping to reduce repair costs, and was gradually developed into a helpful working tool. The most important and effective changes, however, lay in coordinating inspection with repair work, putting the cranes on a definite repair schedule, improving the caliber of the maintenance force, and securing correct spare parts at minimum cost.

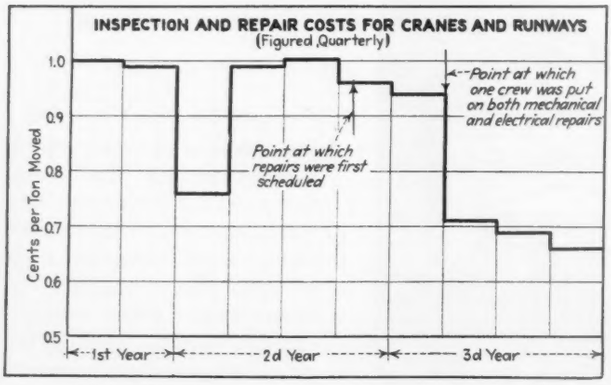
A crane superintendent was appointed to take charge of reducing delays, improving equipment, and lowering costs. He was personally responsible for satisfactory service to the various departments. Every day he visited each group of cranes, and in addition made a detailed inspection of certain parts or of entire cranes. An inspection sheet for each crane was turned in every month indicating which elements were in satisfactory condition or otherwise. Those which showed signs of needing replacement were given special mention together with the probable date required for change or repair.

In order to study operations, a list was kept of production delays. Also duplicate time slips of each day's work were inspected and analyzed, and served as the basis of a brief monthly report on general maintenance aspects.

Delays were gradually lessened; a general operating improvement was noted. Costs dropped slightly. Many recurring troubles were eliminated by correcting the underlying causes. For example, couplings frequently came loose. This condition was controlled by insisting on the fundamental matter of securing accurate alignment of the shafts.

A study of the time cards, however, indicated that matters were far from satisfactory. Crane service was not necessarily the chief concern of either the machine or the electric shop. The best repair men were sometimes called elsewhere when important crane repairs were due. The type of repairs sometimes showed by poor service that they had been made by men who were less familiar with the cranes than was desirable. Also there was a tendency to rush work and possibly to slight it. Each job was done when it was reported rather than by grouping repairs systematically.

A large amount of time was wasted in doing small jobs; about three-fourths of the crane repair orders were for little things, and each required a large amount of wasted time in proportion to the work done on the crane. Getting ready, going to the crane and returning to the shop comprised about one-third to one-half the time charged up. For example, five minutes' work on the crane is required to change a single collector shoe worth 35 cents. Usually the time cards showed two hours' total labor for this item. This represented an electrician and his helper charging one hour each for absence from the



See what happened to crane repair costs when maintenance was placed on schedule and one crew was assigned to both electrical and mechanical repairs. The low cost during the first quarter of the second year was due to sudden tonnage increase coincident with a special drive to reduce labor and material costs

shop. A check of one month's crane work shows there were about 350 repair periods on bridge and monorail cranes. Only 52 of these were charged up at 10 hours or more. About two-thirds (250) of the repair periods were for electrical orders that averaged around $4\frac{3}{4}$ hours' total labor. Each job meant that two men visited a crane and wasted much time in the non-productive labor of going and returning.

After studying this matter from many angles, it appeared that a radical change would produce an improvement. Inspection, repairs, and operation could be controlled and stabilized by systematically grouping, scheduling, and following up repairs.

There was no special expenditure involved in beginning such a procedure. The main thing was to have a clear-cut working agreement between all parties concerned, including heads of departments.

The original plan involved the following requirements:

1. Schedule each crane to undergo repairs regularly one day in every two months. Schedule a certain date and give the department head a few days' latitude.

2. Execute inspection and repairs with the object of putting the crane in condition for two months' service without further attention. Have each job supervised.

3. Take operators in hand and teach them to cooperate.

4. Follow up the underlying causes of repair during operating intervals and endeavor to reduce these as circumstances indicate to be necessary.

There were some few cranes able to meet such a schedule without great difficulty. Others, however, could not do so without improvement in certain particulars. It seemed advisable to begin with cranes which were most likely to make the grade and then tackle the harder ones, so that some difficulties could be ironed out before the bad cases were attacked.

A yearly crane schedule was therefore made out, based on repairing both the bridge crane group and also some monorail cranes in a two-months' interval. No Sundays were scheduled, but the cranes which were the most difficult to obtain were placed on Saturday, which was the next easier day.

It was not expected that the exact scheduled dates could always be met; rather was it up to the department to make arrangements for the necessary repair time as close as possible to that date as suited production conditions.

In the course of time the object of scheduling cranes was realized. Small and large repairs were saved up for the scheduled day when possible, so that all work could be done at one time with the least amount of labor. Repair work was called upon to last for two months until the next scheduled repair day. Systematic studies were made of armature troubles, crane cables, lubrication, and other matters.

The maintaining of spare crane parts had been progressing steadily toward complete centralization. Finally this objective was attained, and regular storekeeping methods were employed. In order to insure that the necessary parts and supplies would be on hand when needed, easily identifiable, and correct in all details, blueprinted specifications were adopted, and one attached to each order sent to the purchasing department. Thus the matter of ordering incorrectly from a manufacturer's catalogue was eliminated.

All parts were subjected to a rigid inspection before being received into the spares department. The parts were issued and charged out on a foreman's order. The number of parts necessary to keep in stock on any one item could be checked up from actual service requirements. In that way, it was found that surpluses could be reduced, thus decreasing the cost of spare parts on hand. Armatures were considered to be the most important and critical of spare parts. After being thoroughly inspected and tested, they were stored on racks where there was plenty of light and heat. Each armature was given a shop serial number.

Although lower costs and better service were attained, nevertheless crane repair work was not all that could be desired. More labor than necessary was still being used. It was felt that the personal interest of repair men could be strengthened by using one special repair crew for both mechanical and electrical work.

The chief inspector was then made foreman and provided with a small force to take care of all outside repairs. Either shop could be called on to assist, if necessary, in an unusually large job such as renewing a truck-wheel bearing header which required much riveting and rigging work. The regular crane crew, however, became so proficient that many large jobs which before had required appreciably more men were eventually handled alone. There was a marked increase in the personal interest that the men took in the work. Many suggestions were made and carried out that led to improved maintenance. When not busy on outside work the men repaired controllers, resistances, brake shoes, etc. A higher grade of inside repair work resulted from the experience of these men with outside troubles.

How the costs of inspection and repair for cranes and runways were reduced by the moves herein outlined, is shown in the figure. The cost of labor and material without overhead is given. Figures for tons moved were derived from net production multiplied by a constant

representing the number of lifts required to take an average ton through the plant. The low cost in the first quarter of the second year was due to a sudden tonnage increase at the same time that a drive was being made to reduce labor and material costs. The average crane, in approximate figures, was of 8-ton capacity and moved 300 tons per day at 3 tons per lift in production only. The majority were pushed to their highest speed anywhere from 8 to 20 hours per day to meet schedules. Wear and tear was high both on cranes and runways.

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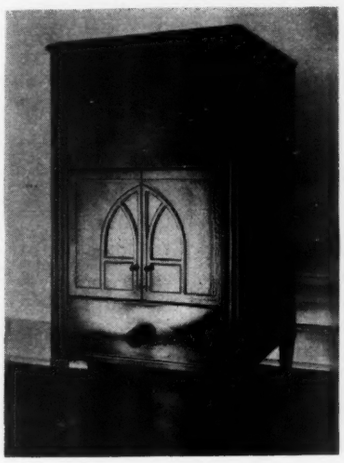
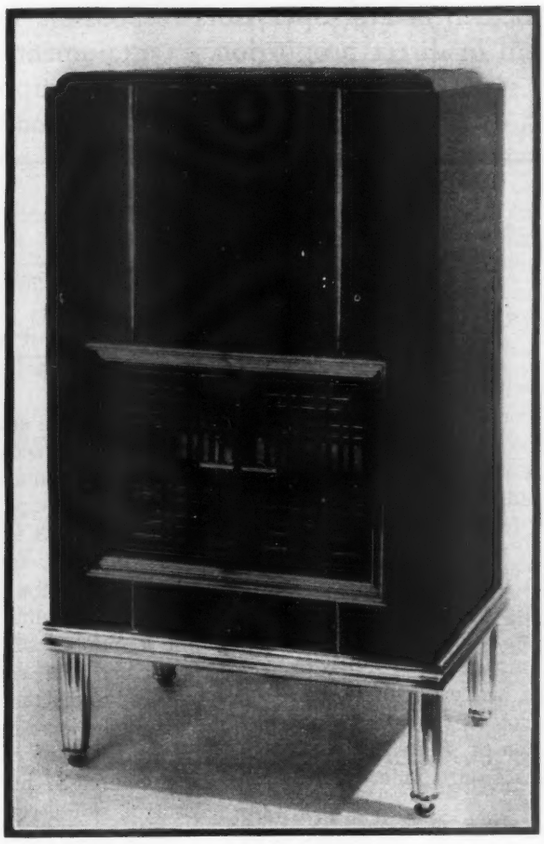
I Ask About Design





C. G. SMITH
Assistant Editor

WE WERE discussing, Walter Dorwin Teague and I, the influence of product design upon sales. He made the point that appearance is no small portion of the somewhat mysterious sum total of things that make goods sell. Could he, I asked, tell me something out of his own experience as a design consultant that would illustrate the point?

So he cited the case of the American Gas Machine Company, Inc., Albert Lea, Minn., and how it sold exactly four times as many space heaters the summer after the product was redesigned.

Briefly, the company made a line of oil and gasoline stoves and lamps, most of the items being camping equipment and therefore highly seasonal. That meant there was a good chance of the factory's being pretty flat in summer. A new product was indicated—something that would fill in the valleys, keep people working the year round.

The oil-burning space heater, or circulator, was a logical choice. The woods were full of competitors, but there were plenty of potential customers left. Apparently the trick, if any, was to engineer a heater which would have certain operating advantages over others. Little thought was given to the appearance of the circulator.

Sales the first season were satisfactory enough. But, after all, the space heater goes into the living room. Could it not be made more attractive and given wider sales appeal?

A study of the product and the facilities for making it resulted in two basic recommendations:

First, that the company break with the tradition of the industry, stop imitating a wood finish, and build a heater solely around the function it was intended to perform. Why try to make a steel box look like wood and then go and build a fire in it?

Second, that the company tone up the appearance of the product and lift it out of competition.

That's the new heater in the larger photograph. True, it costs about 12 per cent more, but judging from the present season's sales, it is four times as good.

It looks like a steel cabinet, safe to build a fire in. It appears to be more solid because the top is recessed, not overhung. The thickness—or thinness, if you like—of the sheet steel is nowhere revealed. There are no joints at the corners; they are brought around to the front and covered with a stock molding, chromium plated. The doors are set in to make the walls look thick. The legs are cast full rounded, not false. A knurled wheel at the bottom of each serves as a leveler and is an integral part of the design. And the old imitation wood, vitreous-enameled finish has given way to a dull brown damaskeen surface which won't chip—a perfect background for the chromium trimmings.

Company salesmen are now stressing, not its mechanical advantages, but its appearance. Why not? If people buy automobiles because they like their looks, why not space heaters? Or why not, indeed, your product?

Bonus for Supervisors Too

Here's a workable plan that cut controllable costs 10 per cent the first six months it was in operation. Belden makes supervisors responsible for expenses under their control, pays them in direct proportion to attainment, and watches the healthy effect on such items as scrap, expense labor and supplies, maintenance, promises to customers, and other problems common to most production jobs

H. H. Steele
In Charge of Time Study
Belden Manufacturing Company, Chicago

THE USE of the incentive plan of payment is not nearly as common in connection with the payment of indirect labor as it is with direct. It will therefore be of interest to describe a plan to provide a financial incentive to supervisors to reduce costs that was applied to this company's Richmond, Indiana, plant on November 1 of last year.

While this plan has been in effect only a year, the controllable operating expense for the first six months was reduced by an average of 10.9 per cent (See Figure 1). In the month of April, a reduction of 18.3 per cent was attained. The plan has had particularly noticeable effects in directing the attention of supervisors, foremen, and inspectors to the reduction of scrap and the keeping of delivery promises. Figures 2 and 3 indicate the results in these directions.

The Richmond plan employs about 400 people in the manufacture of rubber-covered and insulated wire and cords for electrical household appliances and similar products. In this organization, the foremen are not expected to devote their time primarily to the improvement of manufacturing methods, which is largely done by the engineering department, with some assistance from the time-study department. The foreman's job is to see that the expenses under his control are kept at a minimum, that standards of quality are kept up, production schedules met, and satisfactory relationships maintained between the company and the employees of his department. The problem therefore was to devise a plan which would offer a balanced incentive to performance of all these varied duties, many of which were difficult to reduce to exact instructions or measurements.

Classification of Responsibilities—We found that the various responsibilities of supervisors might be reduced to five main classes which are shown with their subdivisions in Figure 4. The responsibility of each supervisor for each class is shown in the columns at the right. Scrap, expense labor, expense supplies, and maintenance expense are self-evident. The heading "special items" covers, for one thing, returned defective material for which, when it occurs, we hold the chief inspector responsible. Special items also include broken promises, when through the fault of the manufacturing department a definite delivery promise to the customer is not lived up to. Foremen of manufacturing departments, as well as the production manager, are held responsible for this item.

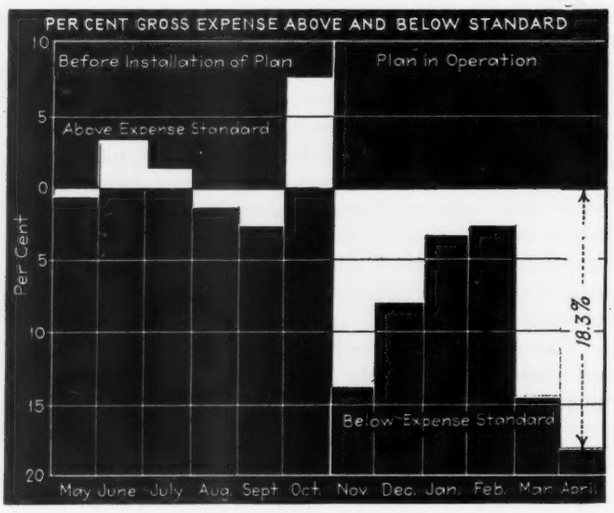
We hold the employment manager responsible for the reduction of accidents and general safety work, and his bonus responds to a decrease in accidents.

The plant superintendent is held responsible for all seventeen items shown.

Setting Standards—The setting of standards upon which to rate the performance of supervisors was recognized as difficult. The plant had operated on a budget for a number of years, and engineering cost-reduction work had been consistently carried on. Costs had been reduced under the pressure of a declining volume of business to the lowest point in years. Any plan which would insure the same close control during a period of increasing volume of business, or perhaps provide even better control, would certainly be worth while.

As a basis for all standards we investigated the actual cost over a period of time for each item. This past performance was taken as a nominal standard or base, and a real standard or objective was established by making a study of the ultimate reduction that could be expected.

Figure 1



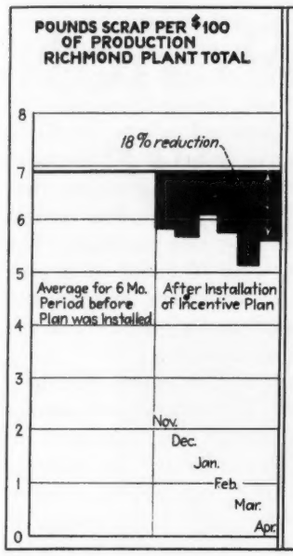


Figure 2

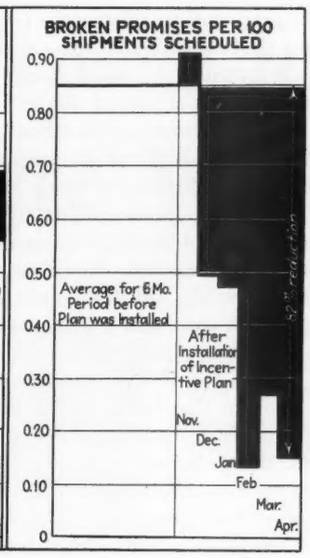


Figure 3

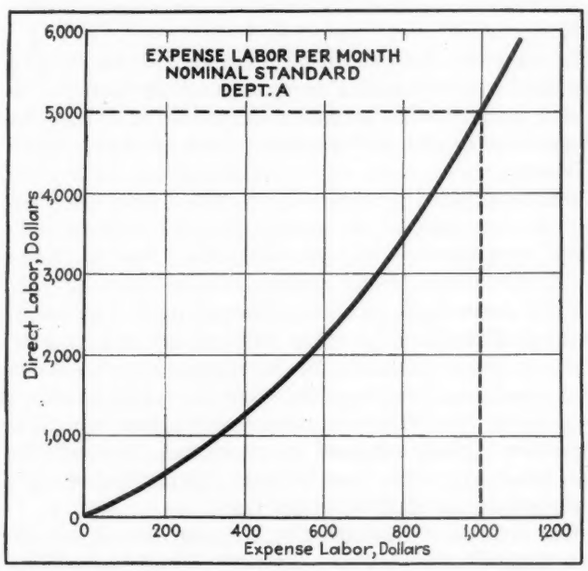


Figure 5

The same method of establishing the objective was not applicable in every case, but an example will indicate the procedure for one item.

One hundred pounds of scrap from the Rubber Covering Department may be analyzed according to causes listed in Table I.

For this item the anticipated ultimate reduction is from 100 to 66.6 or 33⅓ per cent. Here it was possible to make a partial approach to numerical accuracy. In other cases, accident reduction for example, it was necessary to rely almost entirely on judgment.

The expense labor in each department was found to vary with a change in direct labor according to a curve similar to that in Figure 5. An ultimate reduction of 23.6 per cent was anticipated for one department in this case.

The cost of packing and supplies for the shipping room was found to be 0.865 per 100 pounds of shipments. The standard for Item 13 in Figure 4 is therefore set at this amount. The expected reduction was 10 per cent.

Figure 4

ITEM NO.	ITEM NAME	Supervisors Responsible: Foreman Dept. A	Foreman Dept. B	Production Manager	Chief Inspector	Foreman Rec. and Shipping	Maintenance Foreman	Supervisor Safety and Service	Plant Superintendent
	SCRAP								
1	Dept. A Scrap	X			X				X
2	Dept. B Scrap		X		X				X
	EXPENSE LABOR								
4	Dept. A Expense Labor	X		X					X
5	Dept. B Expense Labor		X	X					X
6	Production Office Expense Labor			X					X
7	Finished Stock and Shipping					X			X
8	General Stores and Receiving					X			X
9	Expense Inspection				X				
10	Dept. A Productive Inspection	X			X				X
	EXPENSE SUPPLIES								
11	Dept. A Expense Supplies	X						X	X
12	Dept. B Expense Supplies		X					X	X
13	Shipping Expense Supplies					X			X
	MISCELLANEOUS EXPENSE								
14	Plant Miscellaneous Expense							X	X
	MAINTENANCE								
15	Dept. A Maintenance	X					X		X
16	Dept. B Maintenance		X				X		X
17	Balance of Plant Maintenance						X		X
	SPECIAL ITEMS								
18	Returned Defective Material				X				
19	Broken Promises	X	X	X					
20	Cost of Accidents							X	
21	Shipping Room Errors					X			
	INCENTIVE EARNINGS								
22	Dept. A Incentive Earnings	X							
23	Dept. B Incentive Earnings		X						

Provision equal to 10 per cent of the total anticipated reduction was made under the fifth heading, "Incentive Earnings," for the reduction believed attainable in day-work time, as against time on piecework.

To aid in the application of the plan a detailed description of the activities, expenditures, and results covered by each item in Figure 4 was made up, much like an ordinary classification of accounts.

Basic Principle of Plan—The incentive offered is in the form of a bonus paid in addition to the supervisor's monthly salary. In effect we said to our foremen:

"While you have been operating according to a budget for several years, we know that by more careful planning and closer control on your part further improvement can be made. We have investigated each of the several items under your control, and have determined the possible and probable further improvement or reduction in each case.

"A point rating system has been set up so that a supervisor who succeeds in bringing about the expected per-

Table I

	Present Scrap	Anticipated Scrap
1. *Unavoidable*..... Inherent in operation — starting and stopping machine, etc.	50 lb.	50 lb.
2. *Partially Avoidable*..... Due to use of defective process material, machine trouble, lack of planning, etc.	20 lb.	12.6 lb.
3. *Avoidable*..... Due to carelessness of operators	30 lb.	4 lb.
	100 lb.	66.6 lb.

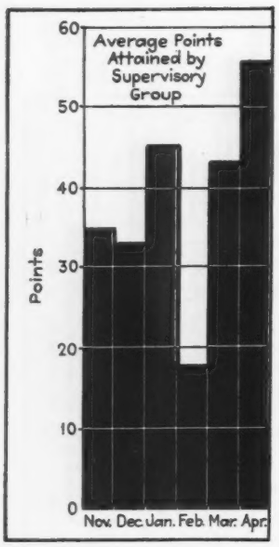


Figure 6

centage of improvement in all of the items for which he is responsible will attain a rating of 100 points, and will receive a bonus equal to 25 per cent of his monthly salary. For lesser improvement, the bonus earned will be in proportion to the improvement made."

Method of Composite Rating—Had there been but one class of performance to pay for, it would have been a simple matter to reduce this performance to points. Thus, if the foreman succeeded in reducing his departmental expense 10 per cent as against an anticipated ultimate 20 per cent, he would have been entitled to half the 25 per cent bonus, or 12½ per cent.

But the object was to direct attention to a composite performance, some of whose elements were more important than others. To do this, the importance of the elements was measured by their annual cost. In Table I, the costs of three items attributable to one department are shown. Fictitious amounts are used to simplify the example.

Expense labor, of $10,000 annually, constitutes half the expense of the department. A reduction of 20 per cent has been established as an ultimate objective. To establish a simple arithmetical method of computing the bonus to which the foreman would be entitled for reaching any fraction of this objective, a point base (column D in the table) was established. The point base is simply the inverse of the ultimate reduction, or that number which, when multiplied by the percentage of ultimate reduction, equals 100 per cent. Thus the point base 500 × 20 per cent = 100.

Now it was desired to pay half the total bonus of 25 per cent for full attainment of the 20 per cent reduction in expense labor. The points allotted for this attainment will therefore be half of the point base (columns B × D) or 250 points.

The per cent reduction in expense labor actually attained is shown in the example (columns F, G, and H) to be 10 per cent. Since the "points allotted" include both the weighting in relation to total cost and the inverse of the expected ultimate reduction, we may now obtain the points attained by multiplying the allotted points 250 by the actual reduction of 10 per cent, giving 25 points.

Similar computations show attained points of 50 in expense supplies, and the negative points of 7.5 in maintenance for failure to reach even present standard performance. Negative points, by the way, are offset against bonus, but not against the man's base rate earnings. The total points earned, therefore, were 67.5 out of a normally possible 100, for which a 25 per cent bonus would have been paid, and a bonus equal to 16.9 per cent of his base rate was paid to this department head.

Period for Which the Bonus is Computed—While it is desirous that bonus payments shall follow performance as quickly as possible, the complete data required for computing bonus were available only in the monthly statements covering manufacturing operations. Bonus is therefore computed on the monthly basis, except in certain cases where a longer period is desirable to smooth out month-to-month fluctuations. Points for reduction in maintenance expense, for example, are computed quarterly.

In proposing the plan to the foremen and supervisors, the right was reserved to drop items which fluctuate too widely, to add other items, or otherwise to change the proportions of the performance points on which bonus is based.

For example, a general wage increase would necessitate new standards. In view of the fact that no individual supervisor would be responsible for such a change, he should neither benefit nor be penalized because of it.

As is shown by figures, the response of the supervisors to the plan has been favorable, although a few were lukewarm at first. Generally, the more complete the control of a department head over the items for which he is held responsible, the better his bonus showing has been. The supervisory group attained an average of 56 points for the month of April, for instance, corresponding to a bonus of approximately 14 per cent.

One byproduct advantage of the plan lies in the fact that the difference between "standard" and "actual" expense for a month gives a direct measure of the actual reduction in operating cost.

The substantial and increasing reduction in operating expense, mentioned at the outset, indicate that the plan has secured a distinctly worth-while saving, while at the same time it has increased supervisors' earnings and interest in their work.

Table II

	A	B	C	D	E	F	G	H	I
Item	Annual Cost	Per Cent of Total	Ultimate Reduction (Per Cent)	Point Base	Points Allotted (BxD)	Nominal Standard for Month	Actual Expense	Per Cent Reduction	Points Attained (ExH)
Expense labor.....	$10,000	50	20	500	250	$1,000	$900	10	+25
Expense supplies.....	5,000	25	10	1,000	250	500	400	20	+50
Maintenance.....	5,000	25	33⅓	300	75	400	440	—10	— 7.5
	$20,000	100							+67.5

Per cent bonus = 25x67.5 = 16.9

More Power for Industry; Where Will It Come From?

As industry stopped its motors and turned off the lights, it released utility generating capacity that has since been absorbed to a large extent in other ways. Resuming full production, it will have to use power more efficiently, may have to produce part of its requirements

G. A. Van Brunt
Associate Editor

WHEN we want to light our homes or operate the machines in our plants we are accustomed to manipulate a switch or push a button. If more motors or lights are needed, they are connected up without the slightest question that an ample supply of power is available. Do the facts warrant any such assumption?

Briefly, at the end of 1929 the rated generating capacity of the public utility plants in the country was about 31,952,000 kw. (One kilowatt is equivalent to 1.34 horsepower.) Energy output for 1929 was 97,000,000,000 kw.-hr. What has happened to industrial production since then need not be detailed here. If the 1929 volume of production were resumed, industrial demand for power would assume substantially its corresponding value. That would represent a load recovery of 2,000,000 kilowatts.

While the industrial power load was falling, much of the generating capacity thus released was taken up by the sale of other equipment. Domestic appliances imposing a load of more than 11,500,000 kw. have been sold. There is an increased lighting load of 10,000,000 kw., with sales of motors and industrial heating apparatus that requires 20,230,000 kw. Allowing for various factors that need not be considered here, it seems fair to say that a total of 4,200,000 kw. has been added to utility loads since 1929.

To offset this additional load, utility companies have added 3,500,000 kw. of generating capacity, which leaves a deficit of 700,000 kw. to be supplied from the reserve capacity existent in 1929, and augmented by the drop in industrial requirements.

Opinions may vary as to what would happen if industrial plants throughout the country should resume production at the 1929 rate. Whatever conclusions may be reached probably would not apply in all regions, because basic conditions are not everywhere the same. From the table, it will be seen that the percentage increases in generating capacity added during the past three years vary rather widely, from 7 per cent in the Mountain Region to 20.1 per cent in the West Southern Central.

Comparing energy outputs for September, 1929, and 1933, it appears that in one region, the East South Central, more energy was consumed in September of this year than in the same month of 1929. In all other regions the energy consumption was lower by amounts ranging from 2.5 per cent in the South Atlantic to 14.2 in the East North Central Regions. How much energy the utility companies in the various regions could deliver cannot be said with certainty.

Complicating the situation is the fact that the "use factor," the ratio of the energy actually produced during a given period to the amount that could be produced if the stations were operated continuously at 100 per cent of rating during that period, decreased 24 per cent. In 1929 it was more than 37 per cent. Under the present lack of necessity for plants to operate overtime, and the shortening of work hours by industry codes, utility station use factor can be taken as about 30 per cent. The practical effect is to concentrate the industrial load over 35 or 40 hours of each week, so that utilities may have to deliver as many kilowatt-hours in the present short-hour week as they did in weeks that contained many more working hours. When that time comes there is every likelihood that many companies will find it difficult or impossible to meet the demand with present generating capacity. It must also be borne in mind that generating capacity cannot be increased overnight. A year or so is required to make any worth-while addition.

What can industrial plants do to meet this situation? Briefly, reduce as much as possible demands made on the utility companies. There are four principal ways of doing this. It is to the advantage of every plant to put these measures into effect, regardless of whether there is ample central station generating capacity available.

Prevention of waste of electrical energy will be mentioned first, although it will likely be of less importance than the others. It is not uncommon to find motors running, lights burning, when no use is being made of these facilities. Carelessness on the part of operators and lack of supervision by management are responsible for wastage of large amounts of energy.

Unless care is used in scheduling the operation of equipment, peaks may be built up at intervals that are excessively high in relation to the normal requirements. Nevertheless, generating capacity and the capacity of

Capacity and Output of Public Utilities

Region	Capacity at End of Year, Kw. 1929	1932	Increase, Per Cent	Output in September, Million Kw.-Hr. 1929	1933	Increase, Per Cent
UNITED STATES...	31,952,396	36,060,593	12.8	8,062	7,344	− 8.8
New England.....	2,650,662	2,940,867	11.1	544	524	− 3.8
Middle Atlantic.....	7,866,813	9,176,571	16.7	2,067	1,894	− 8.3
East North Central...	7,563,023	8,238,629	9.0	1,899	1,626	−14.2
West North Central..	2,216,326	2,653,143	19.5	487	457	− 6.1
South Atlantic.....	3,882,717	4,315,180	11.1	892	870	− 2.5
East South Central...	1,563,046	1,718,029	9.8	317	327	+ 3.0
West South Central..	1,427,688	1,715,049	20.1	443	397	−10.3
Mountain.....	1,110,058	1,189,260	7.0	335	263	−11.6
Pacific.....	3,672,063	4,113,865	12.1	1,077	983	− 8.6

transmission lines, transformers, and other elements must be capable of carrying these peak loads. From the standpoint of the user, reduction of demand to the lowest practicable value is highly desirable, because power bills include a charge based on the highest demand occurring in any 15-min. interval during the month. Obviously, the lower the demand, the lower the bill. Such charges increase the revenues of utility companies, but they do not add generating capacity—which is the important matter.

Reducing demand involves a study of the plant load to determine when the heaviest loads occur, and their duration. A graphic wattmeter will be found very useful, almost indispensable, for this purpose. With the information obtainable from such an instrument the duty cycles of all important items of equipment can be studied and arrangements made, if possible, to shut down in periods of maximum load those drawing the heaviest current.

Manual control of peak loads is likely to be both unsatisfactory and expensive for several reasons, among which is the failure of operators to obey instructions. In such cases the use of a demand limitator may be an inexpensive way of solving the problem.

Low power factor is probably the greatest offender in the matter of needlessly tying up generating and transmission line capacity. A few kinds of electrical equipment, lighting for one, operate at unity power factor. All other apparatus operates at something less than unity. (The term "power factor" refers to the percentage of the total current in any alternating-current circuit which is actually being transformed into useful work, heat, and so on.) Squirrel-cage motors, which comprise the largest single load in most plants, operate at somewhere between 50 or 60 and 90 per cent power factor, depending on the raito of actual to rated load. The result is that the overall power factor of many plants is only 60 or 70 per cent.

From the standpoint of the utility, the practical effect of such a condition may be explained briefly in this way. Assume that an industrial plant operates at a power factor of 70 per cent. Then, neglecting losses, for every 1,000 amp. of line current only 700 amp. is doing useful work. Nevertheless, 1,000 amp. of generating, transformer, and line capacity is required to carry this 700-amp. load. In other words, 300 amp. is, in effect, wasted in transforming 700 amp. into useful work. The generating and other capacity thus tied up can be released to serve other customers only by raising the power factor as close to 100 per cent as is feasible or economical.

Utilities that have a definite policy in regard to the power factor maintained by their customers usually base their rates on, or require, a power factor of 80 per cent. A factor lower than this figure will be penalized in some way. Some utilities pay a bonus for high power factor. As increasing industrial loads reduce the reserve capacity of utility generating stations, it is to be expected that penalties for low power factor will be stiffened and enforced much more rigidly than heretofore.

Correction of this undesirable condition may be accomplished in either of two ways, or by a combination of them. The first method, which attempts to remove the primary cause of low power factor, involves proper loading of all induction motors. To this end the loads are checked, and any motors that are found to be underloaded are replaced whenever possible with motors of smaller rating.

The type of mechanical power drives employed frequently exerts an important influence on the value of the power factor. For example, use of many comparatively small motors for individual drives tends to result in a low plant power factor. Group drives, on the other hand, commonly use much larger motors which are, or can be, loaded reasonably close to rating and, therefore, operate at a considerably better power factor.

The second method involves positive correction by means of synchronous motors or condensers, or by static condensers, commonly called capacitors. Which of these types of equipment should be chosen, depends on the conditions. If any considerable part of the plant load can be handled by synchronous motors, the problem of correcting low power factor may be solved satisfactorily and at reasonable cost in this way. When, as sometimes is the case, all of the motors in the plant are comparatively small, the use of capacitors or synchronous condensers is indicated.

The question of whether to make or buy power, either wholly or in part, has always been a live one. It is very much to the fore at the present time, and its importance will increase if a shortage of utility power develops.

For a long time the average industrial plant had the choice of buying utility power or operating its own power plant, in which reciprocating steam engines drove the generators. Within the past few years great progress has been made in the design of internal combustion engines, notably the diesel engine. At the same time good advances have been made in the design of steam engines and turbines, and the latter in particular have been made available in comparatively small sizes. As a result, the industrial plant that wants to make its own power can do so with either steam or oil engines, and at a cost per kilowatt that equals, and will in many cases be lower than, that of utility company power. Whether a plant is justified in operating its own generating station, and whether that station should be steam or oil driven, depends on many factors that can be evaluated properly only by competent engineers. If there are engaging possibilities of making savings and securing other advantages, there are also many possibilities of making costly mistakes. These can be avoided by proper handling of the engineering and economic problems involved.

To Buy or Not to Buy Equipment

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How to find out when a capital goods investment is sound business

Six major points demand consideration in determining when changes of equipment in an existing plant are economically justified:

1. Years required for investment to pay for itself.
2. Per cent of operations for equipment concerned.
3. What items of cost to consider.
4. Cost factors which effect a saving.
5. Factors which may offset all or part of the saving.
6. How to choose between alternative proposals.

IN MAKING any improvements we are constantly confronted with the possibility of obsolescence of the equipment due either to the development of a new machine or to a change in the market demand. For this reason, under normal business conditions, it is felt in many industries that an improvement should pay for itself in three years or less. In severe depression, where the conserving of cash is paramount, companies are inclined to work on the basis that an improvement must pay for itself in one year.

In evaluating the expected savings, it is important to estimate correctly the hours that the machine will work or the tonnage required of it, based on past experience and the expectation of the future. If the computations are made on the possible production from the machine with full operating hours at all times, a false saving may be developed. This would be true, for example, if in normal times the sales department could supply orders to keep a machine busy only 50 per cent of the time.

To bring out these conditions we will consider a machine operated by six men, normally running 5,000 hours a year, and producing 25 units per hour with 2 per cent rejections, with the material costing $4 per unit delivered to the machine.

In Example I, we propose to replace this machine with another unit costing $15,000, which will have no greater rate of production nor any change in rejections, but which can be operated with two men in place of six, at a reduced power cost and somewhat increased repair cost.

EXAMPLE I

	COST PER OPERATING HOUR	
	Present Equipment	*Proposed Equipment*
Material Loss	25 x $4 x 0.02 = $2.00	25 x $4 x 0.02 = $2.00
Labor	6 Men x $0.50 = 3.00	2 Men x $0.50 = 1.00
Repairs	.50	.75
Supplies	.10	.10
Power	2.00	1.50
Total Cost	$7.60	$5.35
Hours Operated	5,000	5,000
Units Produced	125,000	125,000
Gross Saving	($7.60—$5.35) x 5,000 = $11,250	
Gross Return on Investment	$\frac{\$11,250}{\$15,000}$ = 75 per cent	

This machine, by showing a 75 per cent gross return on the investment, will pay for itself during the second year, and ordinarily would be considered with favor.

Let us consider a second case—of a machine costing

Presented before the National Association of Foremen at Akron, September 16, 1933.

$45,000—where the number of men is doubled per machine, and repairs, supplies, and power are also increased per hour, but with the important difference that the rate of production is ten times greater than that of the old machine. In this case the hourly cost of the proposed machine will much exceed that of the old equipment, but due to its more rapid rate of production there will be a gross saving, as shown in Example II.

EXAMPLE II

COST PER OPERATING HOUR

	Present Equipment	*Proposed Equipment*
Material Loss	25 x $4 x 0.02 = $2.00	250 x $4 x 0.02 = $20.00
Labor	6 Men x $0.50 = 3.00	12 Men x $0.50 = 6.00
Repairs	.50	1.50
Supplies	.10	.50
Power	2.00	3.00
Total Cost	$7.60	$31.00
Hours Operated	5,000	500
Units Produced	125,000	125,000

Gross Saving:

Present Equipment $7.60 x 5,000 = $38,000
Proposed Equipment 31.00 x 500 = 15,500

$22,500

Gross Return on Investment ..... $\frac{\$22,500}{\$45,000}$ = 50 per cent

This machine will pay for itself in two years, and the investment probably would be considered with favor also.

We are now confronted by this situation. Two new machines have been considered to do the work. One will give a gross return of 75 per cent; the other, 50 per cent. At first thought the 75 per cent return proposal, which costs the least to install, would appear to be the more desirable. However, the other machine, although it costs more, also saves more money. The problem (See Example III) then becomes a determination of the additional return on the additional investment.

EXAMPLE III

	Proposed Equipment	
	Gross Saving	Installation Cost
Example II	$22,500	$45,000
Example I	11,250	15,000
	$11,250	$30,000

Gross Return of Additional Saving on Additional Installation Cost ..... $\frac{\$11,250}{\$30,000}$ = 37½ per cent

The figures indicate that there will be a gross return of 37½ per cent on the additional investment. In other words, the additional investment would be returned in somewhat less than three years. Under normal business conditions this would be considered satisfactory, and in all likelihood the more costly machine with its 50 per cent return on the investment would be chosen in the place of the one with the 75 per cent return.

In all the foregoing cases the rejections have been considered to be the same. However, let us suppose the proposed improvement, Example I, will have 4 per cent rejections as compared with 2 per cent on the old machine. In this case the added cost due to the increased losses would nearly offset the saving in operating costs, with the result that the gross return on the investment would be only 8.3 per cent, as indicated in Example IV.

EXAMPLE IV

COST PER OPERATING HOUR

	Present Equipment	*Proposed Equipment*
Material Loss	25 x $4 x 0.02 = $2.00	25 x $4 x 0.04 = $4.00
Labor	6 Men x $0.50 = 3.00	2 Men x $0.50 = 1.00
Repairs	.50	.75
Supplies	.10	.10
Power	2.00	1.50
Total Cost	$7.60	$7.35
Hours Operated	5,000	5,000
Units Produced	125,000	125,000
Gross Saving	($7.60—$7.35) x 5,000 = $1,250	
Gross Return on Investment	$\frac{\$1,250}{\$15,000}$ = 8.3 per cent	

This installation would not pay. It is an example of how care must be exercised in figuring improvements. On the surface this machine would seem very desirable and from operating costs alone would appear to give a 75 per cent return on the investment, but when considering all angles the return is only 8.3 per cent. These items of added cost require the most careful scrutiny. They may appear in increased cost in the process in the next department or increased cost of the material delivered to the machine, or may affect the operation of some other machine in the department; the loss from any of these causes may go a long way toward offsetting the saving on the proposed machine.

Let me leave with you a word of caution in making sure you are standing on solid ground when making a request for an improvement. Below are five of a group of set questions, which, for a number of years, I required each man working for me on improvements to answer in writing before submitting any proposition. If these questions can be answered positively, you may feel fairly safe that the conclusions will be sound:

1. Have all of the elements of influence been considered?
2. Have all figures and decimal points been properly checked?
3. Have you made an approximate cross check by an entirely different method to see whether you can approximate the same answer?
4. Have you familiarized yourself with the actual operation of the process?
5. Above all, is the answer reasonable? If the computations do not give us a reaction as being "commonsense," you may be sure that somewhere your studies and calculations are unsound. By all means do not take any steps with the improvement until you have satisfied yourself in this respect.

By following a procedure as herein outlined, you should be able to evaluate the possibilities of an improvement and satisfy yourself that what you are about to do is or is not economically sound.

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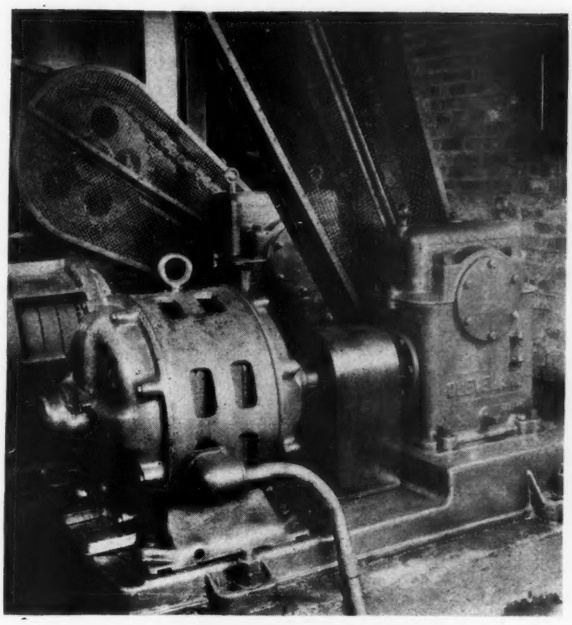


In many plants production considerations should be the deciding factor in choosing between group and individual drives

Robert W. Drake
Mechanical and Electrical Engineer
De Kalb, Ill.

How Production Needs Govern Choice of Drive

WHENEVER a group of men discuss mechanical power transmission the one subject which is sure to crop up sooner or later is individual *versus* group drive. In any study of the application of power in industry this matter must be considered to be of universal interest and may as well be put first.

In my opinion there is scarcely a plant which should be group driven throughout, or individually driven throughout. Indeed, there are few manufacturing rooms in which both methods of drive will not find a place if the layout is intelligently planned.

During the last 30 years industry has passed through a complete swing of the pendulum of preference for all group drive—large groups at that—to a preference for individual drive which led to such misapplication in some situations that it made competitive manufacturing well-nigh impossible. The pendulum seems to be swinging back again. Very likely in the next decade it will swing too far once more. At any rate the group drive of today is much different from the group of 30, 20, or even 10 years ago, which is true of the individual drive, also.

Let us dismiss the idea of attempting to follow "fashions" in factory equipment and consider the basic fundamentals on which a decision should rest, as between group and individual drive.

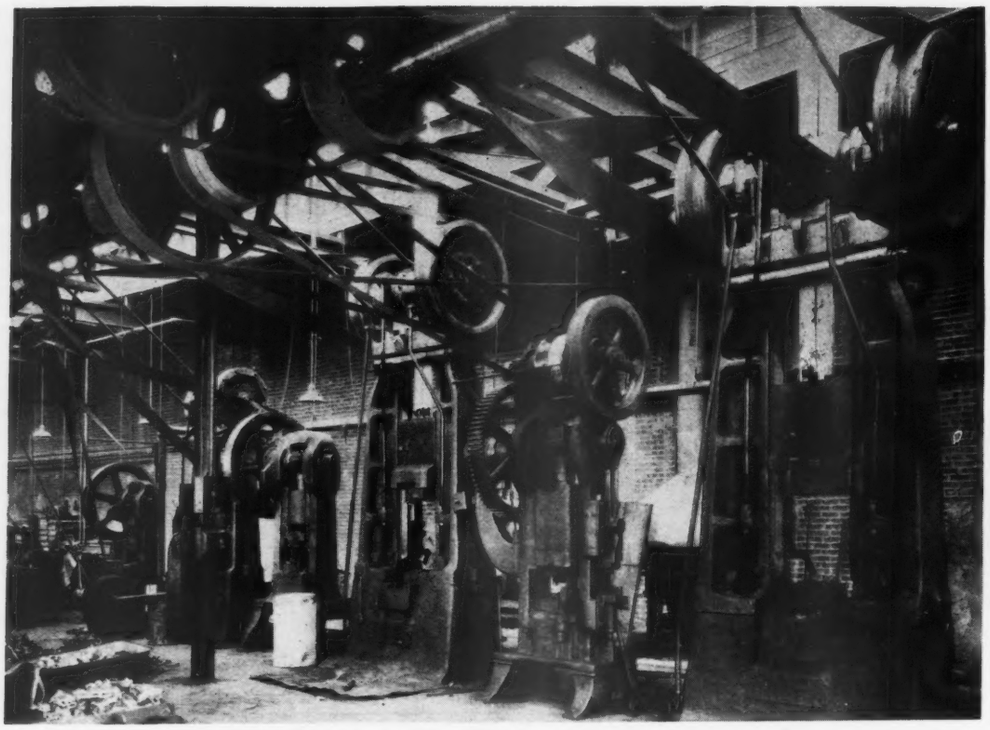
There are, of course, many cases where it is self-evident that one or the other type of drive is best fitted, and no consideration is necessary. Thus, machines over which crane service is essential must ordinarily be individually driven. So must machines in isolated locations, and those that are widely scattered to provide space for a large volume of rough and finished stock. Individual machines requiring 25 horsepower or more and providing a fairly uniform load may well be considered for individual drive. Machines which would require a countershaft if grouped, and which must be moved from time to time, would ordinarily be individually driven, as would machines which are located at odd angles to meet requirements of materials handling or production.

The majority of applications which require a wide range of speed variation, particularly if many steps or stepless adjustment is a distinct advantage from the production standpoint, are best served by individual motors of the d.c. variable-speed or a.c. brush-shifting type.

Even when the first cost of an installation providing variable speed through motor control somewhat exceeds the cost of mechanical speed changers, because there are only a few machines, it is almost invariably preferable because of fewer delays and lower maintenance cost.

Similarly, certain applications would immediately be selected for group drive by almost any experienced plant engineer. Foremost are machines with extreme load fluctuations, such as drop hammers, or machines having extreme load peaks of several seconds' duration.

Machines whose nature unmistakably prescribes a



suitable type of drive are in the minority. Well over half of the machines in industry may be driven satisfactorily either individually or in groups without resorting to exceptional expedients. Ten years ago there were decided difficulties apparently inherent in each type of drive, as developed up to that time. The rapid development during the past few years in mechanical transmission details and in motors with special characteristics has routed the old bugbears in both types of drive.

Belt stretch and insidious losses in production from belt slippage in group drives are now almost unnecessary. The early difficulties with short-center drives, characteristic of individually motored machines, are easily overcome with standard commercial equipment. The elimination of these and other mechanical transmission troubles is as yet by no means universally accomplished in industry, but the means are available. They can be applied at a cost which is moderate in comparison with the losses incurred by allowing the difficulties to continue. This matter will be discussed in more detail later. The point I wish to make here is this: More than 50 per cent of the machines used in industry will apparently operate about as well when group driven as when individually driven. Usually when performance appears to be about a stand-off, we make a choice on the basis of cost; sometimes on the basis of total annual cost, or, less logically, on first cost.

In this particular case there is another group of considerations that are sometimes of greater importance than a considerable difference in total annual cost. The equality in performance may be only apparent. Under the conditions of a particular plant or a particular industry, the method of drive may seriously affect production in some obscure way, which really gives an advantage to the plant with another type of drive.

It is useless to attempt to detail here all of the ways that this can happen. There are many of them, the majority applying to particular parts of particular industries only. There are two ways to attempt to foresee these matters, which I call production considerations. One is by visiting other plants in the same or a similar industry and making an earnest effort to learn the difficulties experienced with each type of drive. Valuable suggestions are often obtained for eliminating the mechanical difficulties which may be overcome by means of improved mechanical transmission equipment. Second, by reflection it is often possible to foresee the most serious difficulties.

To make my meaning plainer I will explain in some detail the two "production considerations" most commonly met in my experience, which at their worst are very serious indeed in their results.

First, consider a plant employing progressive manufacturing and progressive assembly. Many plants which work on the progressive principle actually have available in an emergency a stock of finished piece parts, with which assembly may be continued for hours. Perhaps parts manufacture is carried on at the main plant, to supply one or more distant assembly plants.

In the plant which we are considering this is not true. Parts manufacture is carried on in space contiguous to the assembly line. As a matter of principle, no stock of finished piece parts is maintained. Thus is avoided the investment in such a stock, as well as the cost of handling to and from storage, and the clerical labor of accounting for and maintaining such a stock. Such practice is rapidly growing in popularity.

Manufacturing delays are troublesome and expensive in all plants, but paralyzing in the plants under discussion. If an enforced delay of a tool producing even a minor part of the assembly persists for more than a few minutes, usually for decidedly less than an hour at most, assembly must cease.

In a single-shift shop where operating conditions are

favorable, with the highest grade of maintenance, failures causing delays of one hour or more of ceiling-mounted, open motors driving groups may be held below one a year for each hundred motors in service. Similarly, with open motors driving individual machines we may expect about five delays of one hour or more a year for each hundred motors in service. With inclosed, fan-cooled motors there will be two or three such delays.

These figures do not include all motor failures, as is evident. We all realize that the life of a winding does not approach 100 years. Many cases of motor trouble will be handled so that the resulting delay is less than one hour; others will be nursed along until noon or Saturday.

Whether machines are driven in groups or individually, a motor failure is likely to produce a delay. In this respect the two types of drive are on a par. The difference arises from the facts that individual drive necessitates use of, say, ten times as many motors and controllers as group drive, and that each motor driving an individual machine breaks down on the average several times as often as a group motor.

Individual motors are much smaller than the motors required to drive the same machines in groups. As a result, a very large proportion of individual motors fall in those sizes built with partially closed slots, so that the windings lack the ruggedness characteristic of pre-insulated coils.

Load peaks and load fluctuations are far less severe in group motors, for in a group it is seldom that all machines take maximum power at the same time.

Individual motors are commonly mounted lower than are the motors driving groups. Hence, they are more likely to fail through the entrance of foreign matter into the air gap, or through the effect of oil, coolant, grinder sludge, and the like upon the winding. For this reason there has been a tendency during the past few years to use inclosed, fan-cooled motors on individual machines. This practice greatly reduces motor failures, but the inclosed, fan-cooled motors, designed as they are for operation at a much higher temperature, cannot approach the winding life of the larger, open motors mounted on the ceiling and driving groups.

Experience bears out the statement that an intelligently maintained shop in which 500 machines are driven in groups may expect a delay of an hour or more every year due to motor trouble on one or another of, say, 50 motors, whereas the same department, individually driven with 500 open motors, may expect a similar delay every week or, with inclosed, fan-cooled motors, perhaps twice a month.

It is evident that a plant subject to serious delays every week *must* carry a complete line of spares. Otherwise, a considerable portion of such delays will persist until a motor can be rewound or another motor, possibly having different dimensions, rigged up with suitable pulley, sprocket, sheave, or pinion, and mounted—a matter of many hours.

In the next example it will be seen how a difference in manufacturing conditions alters the results of the same situation.

Consider a plant employing progressive assembly, but purchasing many piece parts in quantities and manufacturing others in departments not contiguous to the assembly conveyor. Intermediate stocks of semi-finished and finished piece parts are necessary. A delay of an hour or two on a motor driving a machine or a group of machines will not be calamitous. In such cases a decision as to the type of drive will be based primarily upon other considerations than the effect of motor failures.

As an extreme contrast to the types of manufacturing just mentioned, consider a plant where the machines are grouped by the operations which they perform. The plant works chiefly to stock. In most cases a considerable number of identical machines are installed in each group. Usually, if one individually driven machine is out of service, due to a motor failure, there is no great inconvenience. At worst, one or more identical machines may be operated overtime or on Sunday to offset the loss of production. On the other hand, a delay of a group involving all the machines of one kind may be very troublesome, even calamitous if no spare motor is available and the delay persists for a couple of days, until a motor can be rewound.

Before leaving this phase of the subject, let us consider briefly the jobbing shop. The tool room and the repair departments of a large plant are essentially jobbing shops.

Here a motor failure on one individually driven machine may be troublesome, but it will seldom result in more serious difficulty than failure to make promised delivery. If there is another machine of the same general sort, and often there is another, then even this contingency is remote. With individual motor drive and, say, twenty machines installed, we may expect, with rather inadequate maintenance, a motor failure a few times every year. If the same shop is driven in two groups, perhaps three, a group motor failure will be much more serious, but it will occur only once or twice in a lifetime.

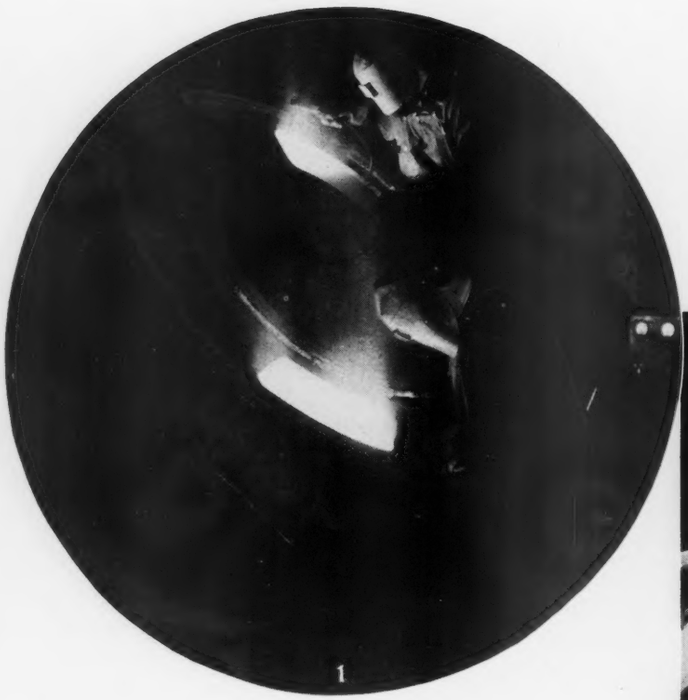
In some industries the tendency of the past few years toward smaller manufacturing orders, together with certain advantages of progressive manufacturing, have put a premium upon ease of change in machine location.

For a machine tool which may be relocated several times a year, individual drive has definite advantages as to the cost of a move and the time required for machines which require a countershaft if group driven. On the other hand, with machines that require no countershaft, it is usually just as cheap and takes no more time to move a split driving pulley and lace a belt, than to change electrical connections to an individual motor. Where certain machines are moved very frequently, they may be driven through heavy-duty cord from conveniently located plug outlets, if individually motored.

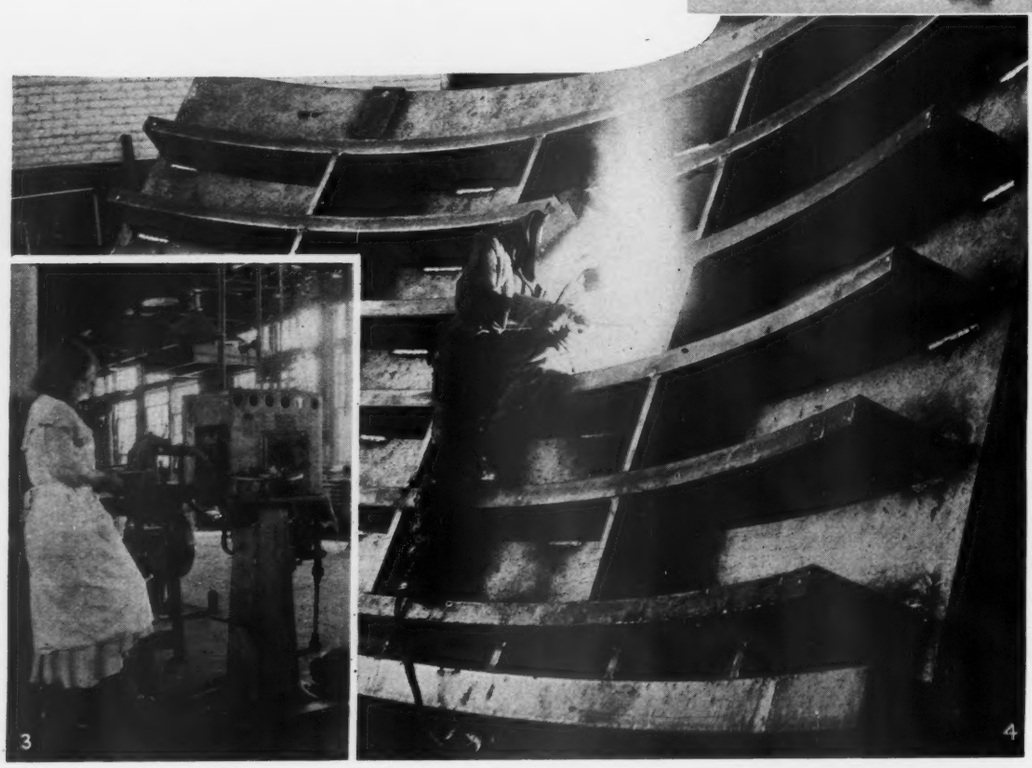
Conditions in the ordinary manufacturing plant are not often intermediate in nature. There are advantages and disadvantages for each general type of drive; none of them is of controlling importance. However, this discussion will indicate how the type of drive will affect continuity of manufacturing. I trust that it may form a basis for reflection upon the special conditions pertaining to any other type of industrial plant.

In many cases an intelligent choice of drives may well be determined by economic or other special considerations. In a successive issue the relative first costs and annual costs of the two types of drive will be discussed.

Eight of the countless production jobs to which modern welding is bringing lower costs . . . .



Where Welding Works

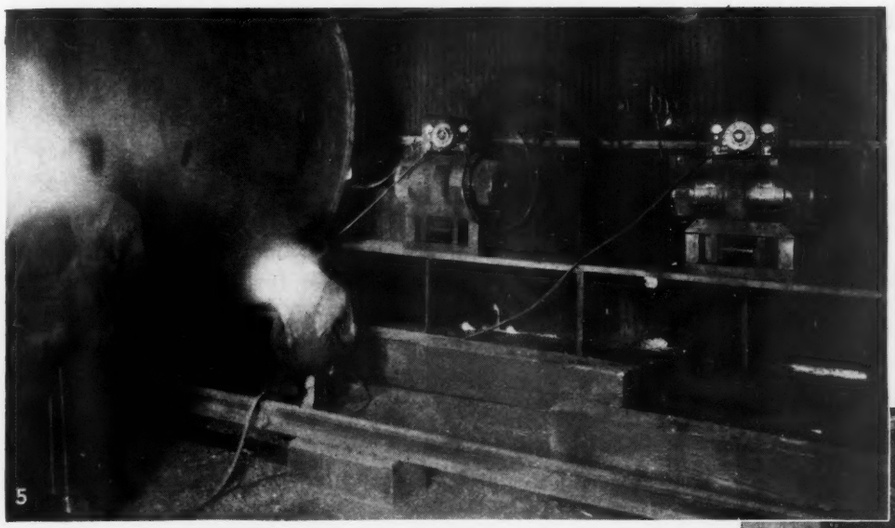


1 Weight may be a deciding factor. At the Harnischfeger Corporation's plant, Milwaukee, important weight reductions are achieved by welding huge gear blanks

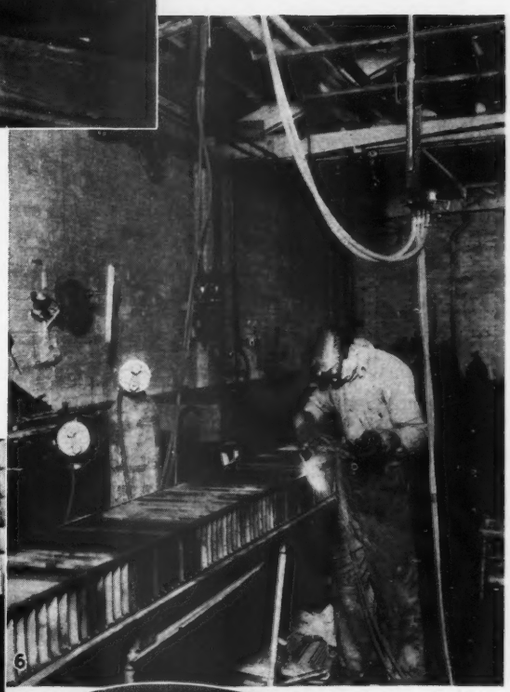
2 Sheet-metal flue for gas-fired domestic refrigerator held in a jig while being welded

3 One of a number of spot welders that handle both radio and cream separator parts at the Colonial Radio Corporation, Buffalo, N. Y.

4 Welding a gate section for the Boulder Dam intake towers in the Westinghouse shops

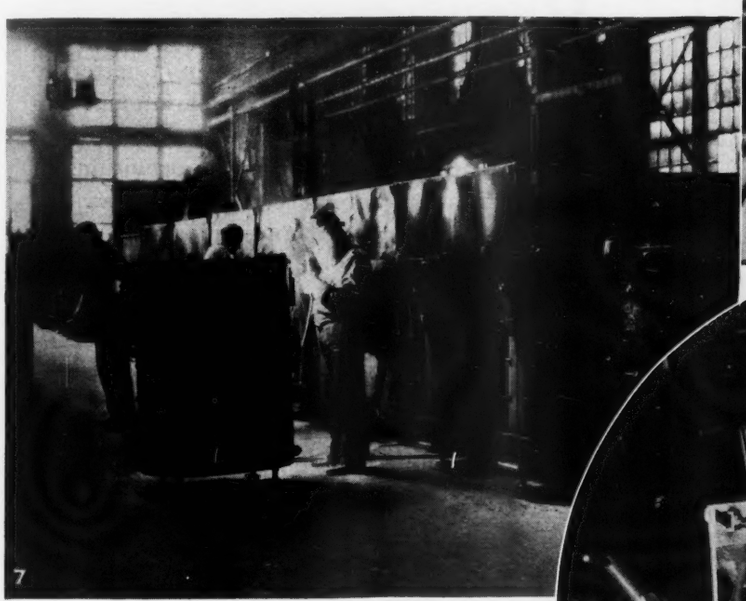


5 One hundred and forty-six 40,000-gal. steel tanks for the Manor Brewery keep welders busy at the Buffalo Tank Corporation, Staten Island



6 The Reliance Refrigerating Machine Company, Chicago, welds the fin coil cooler assembly for a new air-conditioning unit

7 Welding boilers for the General Electric oil furnace in that company's Pittsfield (Mass.) plant



8 Edward Valve & Manufacturing Company, East Chicago, Ind., uses welding in the production of small forged steel valves

Factory Management *and* Maintenance

A consolidation of *Factory and Industrial Management* and *Maintenance Engineering*

L. C. MORROW, Editor

DECEMBER, 1933

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Bargaining

COLLECTIVE bargaining by way of cooperation between management and employees is gaining headway. Recent adherents are Chrysler (*F. M. & M.*, Nov.) and Goodrich (this issue, pp. 519-20).

Both the Chrysler and Goodrich plans include wages and hours as matters to be considered. Some of the older Works Councils shied away from these two, aroused suspicion and resentment thereby. Both must be a part of genuine collective bargaining.

In 1932 the membership of factory employees in Works Councils equaled the union membership in industries (National Industrial Conference Board). By the end of 1934 the same position probably will have been reattained. This is a prediction that the Works Council will overcome the lead acquired by the American Federation of Labor since the NIRA was passed.

The Works Council plan provides that employees be represented by men and women of their own choosing—men and women with whom they work and who are familiar with their specific problems and needs. It does not prohibit membership in a union or other organization, nor does it compel membership of any kind. Its worth in arbitration is indicated by the record of the Bethlehem Steel Company, whose Works Council, during its fifteen years of life, has arbitrated 6,000 cases, about half of which were concerned with working conditions and wage rates.

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Precedent

A CLARIFYING precedent is the regulation concerning the purchase of equipment adopted by the Cotton Textile Industry Committee and approved by the National Recovery Administration (see page 486).

Textile World sums up: "Manufacturers are not restricted in their right to purchase machinery for replacement purposes. They will find that they *must* purchase machinery for replacement purposes." And adds:

"The industry's equipment has deteriorated seriously during the last few years—as figures of machinery sales strikingly reveal. The significance of this point to the individual manufacturer rests in the fact that, with wage chiseling restrained, he now has a chance once more to secure a premium on efficient management, efficient methods, and efficient plant. In fact, those factors again become the major potential sources of profit."

True in the textile industry—true in other industries.

Welcome precedent.

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Labor

BECAUSE 7(a) is a part of the Act, and because no interpretation is permitted in any code, the statement concerning this paragraph made by the President in a letter to General Johnson becomes of paramount importance:

"While there is nothing in the provisions of Section 7(a) to interfere with the bona fide exercise of the right of an employer to select, retain, or advance employees on the basis of individual merit, Section 7(a) does clearly prohibit the pretended exercise of this right by an employer simply as a device for compelling employees to refrain from exercising the rights of self-organization, designation of representatives, and collective bargaining, which are guaranteed to all employees in said section."

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Self-Government

WHATEVER happens to the Swope plan for a National Chamber of Commerce and Industry, it will have served to spotlight the heretofore quiet conflict for control of industry.

Today industry is represented by its own men in the major NRA problem—codification. What of tomorrow's problem—enforcement? Shall it remain in the hands of industry, or become a function of some government bureau?

The Swope plan set up a complete sequence of operations and organization for industry as related to NRA codes; provided for the part that trade associations should play in setting up code authorities; arranged for gathering the data the law requires; made a place for the important National Industrial Conference Board as the center of statistical information and prophecy; set up as a final capstone a big new Chamber of Commerce and Industry with a Board of Appeals to settle trade association problems and conflicts as regards codes; established a panel of eminent business men who, together with government representatives, would have a high place in enforcement.

When the Swope plan was announced suddenly, with no building up toward its reception, labor reared, Consumers' Advisory Chairman deprecated, industry misunderstood, the President was wisely neutral.

As a result of the reception accorded it the Swope plan has been tabled. Perhaps it will reappear in some other guise very much as important parts of the original Swope plan reappeared in the NIRA.

At any rate, the problem of industry self-regulation versus bureaucracy has been brought out into the light. The administration does not want bureaucratic control, has promised industry self-regulation from the first. Industry, not so badly scared as it was last spring, inclines more and more toward independence.

So, probably, we shall have industry self-regulation as the final outcome. But there is the immediate danger that industry apathy and quarreling will be pounced upon by the bureaucratic forces of Washington and used toward their own consolidation.

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Waste

RECEIVED, 146,046 tons of material. Sold as manufactured product, 33,762 tons. Loss of materials, 112,284 tons. The figures are those of C. R. F. Engelbach, of the Austin Motor Company, in his presidential address to the Institution of Automobile Engineers (British). Of the materials received, 74 per cent were consumed, or wasted in process.

Here is a new kind of check in efficiency that gives a hint of possibilities ahead. In manufacture, we are prone to preen a bit about our economy in man-hours. If we use this new gage shall we find a penny-pound situation?

Pace

LETTING conveyors set the working pace is an old procedure that deserves renewed consideration at this time.

Suppose that weekly pay for normal effort on timed operations must be but little above the minimum wage at an hourly rate. It is natural that less than normal effort will be exerted by some operators. They will choose the reduction in effort in preference to the slight increase in pay.

Obviously the speed of the conveyor may be regulated to remove the existence of choice. There need be no inhumanities; there can be less costly production, bigger pay checks.

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Just to Be Sure

AFTER a three-year shutdown a large traveling crane recently was put back into service. The hoist motor armature promptly went out. A spare armature was installed—and likewise went out, promptly. Crane service, badly needed, was held up until one of the armatures could be rewound.

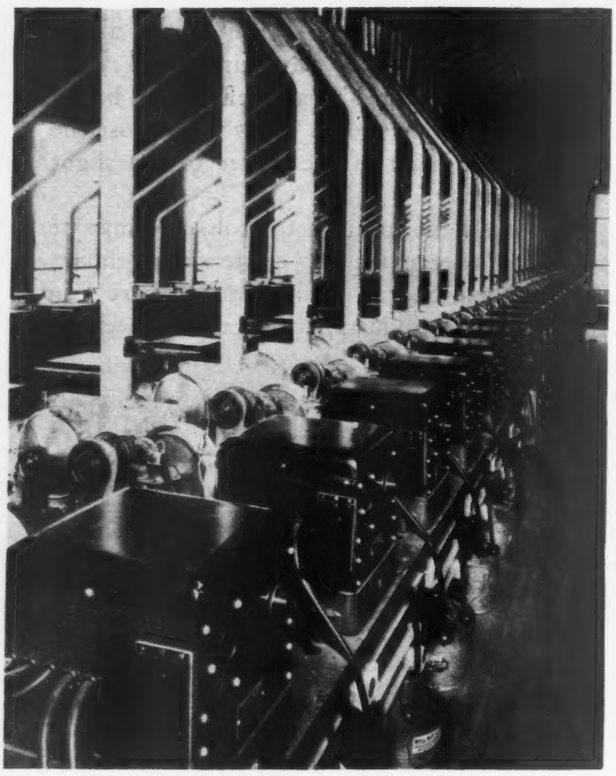
With some variations this same story could be told of many plants. In many, perhaps all, such cases failure of the motor is the result of neglect to make a test which every electrical superintendent knows, or should know, about. We refer to the insulation resistance test.

When a motor or other apparatus is in operation enough heat is generated to keep the windings dry, under any ordinary conditions. After the machine has been shut down and allowed to cool moisture is likely to find its way into the insulation, and the ground is prepared for early failure.

Nor are new coils, or spare armatures and stators immune to the deteriorating effects of storage under poor conditions, which means primarily cold and dampness, usually with dust and dirt thrown in for good measure. There is no certainty, of course, that a motor which has been idle for some time, or an armature that has been in storage for a couple of years, will fail when put in service—but there is likewise no assurance that it will not.

An insulation resistance test will dispel any uncertainty by showing whether the part is in condition for immediate use, or whether it should be dried out in an oven and, possibly, treated with insulating varnish.

· SHORTS FOR MANAGEMENT FOR MAINTENANCE ·



Sorting by Photocell

SOURCE: General Bean Co., Lowell, Mich.

Hand sorting, even when done under the best of conditions, gives only an approximate grading and at high cost. Most human eyes respond quickly only to wide variations in color and other physical characteristics.

Recognition of this fact has led the General Bean Co., Lowell, Mich., to resort to the use of a battery of 100 photocell grading machines which sort up to 50,000 pounds of white pea beans a day, bring the cull content down to less than one per cent, and assure uniform quality, with no stones, dirt, or badly colored beans.

With hand sorting, speed of production is contingent upon the percentage of colored beans present. The photocell grader maintains the same rate of speed whether culls run 5 or 25 per cent. Briefly, individual beans are brought before a photocell in such a way that a trigger-like device knocks any dark or spotted object into the discard. The only imperfect beans accepted by the machines are those with a spot so small that it is on the side of the bean which does not face the electric eye in passing. These bad beans are caught in a final inspection as beans are conveyed from machines to bagging bins. When the machines are in operation, small lamps wink on and off whenever a bad bean is kicked away. If the light stays on, the machine is at once cut from the line and inspected.

Conveyor Safety Gate

F. W. WATSON, Plant Engineer
The Toronto Carpet Mfg. Co., Ltd.

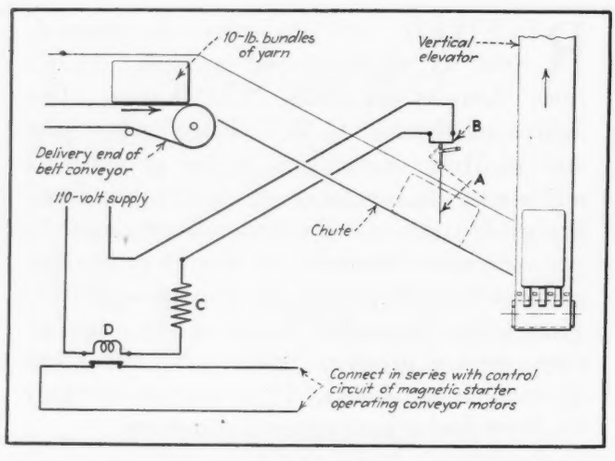
Some time ago we installed a system of belt conveyors to deliver 10-lb. bundles of yarn from the dyehouse to the weaving department. Three horizontal 24-in. belt conveyors were used, terminating in a short metal chute which delivered the yarn to a vertical belt elevator provided with collapsible forks to carry the bundles of yarn four stories into the yarn storage room.

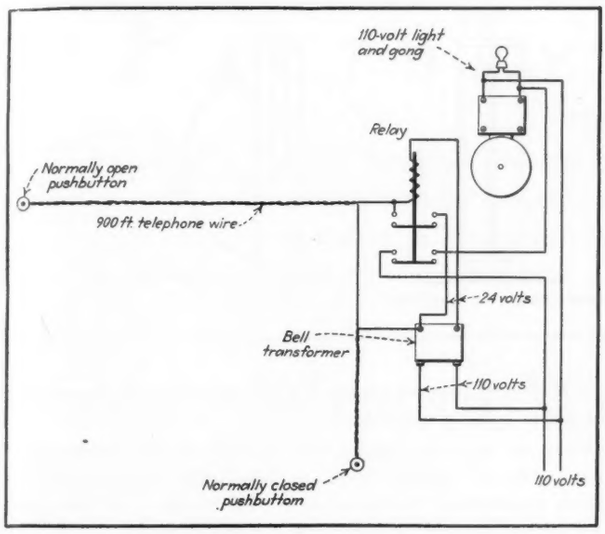
In the event of failure of the belt elevator, the horizontal conveyors would still operate, piling up yarn in the metal chute—and finally on the conveyor belt, resulting in damage to the yarn. This section of the conveyor was located in the stairwell of the building and could not be observed by any of the mill employees.

It was necessary to devise a simple and inexpensive safety device to shut down the conveyor system in the event of failure at this point. The arrangement we worked out is shown in the illustration; it utilizes the thermal relay from a standard magnetic motor starter.

Bundles of yarn passing down the metal chute swing open the safety gate *"A"* placed in the chute, and by means of a cam attached to the gate momentary contact is established at the push button station *"B"* mounted directly above the cam. *"C"* is the element from a standard 500-watt electric heater, and is connected to a 110-volt supply when contact is made at *"B."* In series with the 500-watt heater is the heater coil of a standard thermal relay *"D."* The 500-watt heater takes 4.5 amp., so that the thermal relay has a 4-amp. heater coil. The thermal relay is in series with the control circuit which starts and stops the conveyor motors.

During normal operation of the conveyor system the momentary contact made at "B" when the bundles of yarn swing open the gate *"A"* has no effect on the thermal relay. If, however, the chute becomes blocked with yarn due to failure of the vertical belt elevator, sustained contact at *"B"* causes overloading of the relay, causing it to trip and shut down the driving motors.





Operating 110-volt Signal From 24-volt Circuit

T. G. Ellis, Toronto, Canada

Recently we were called upon to install a red light and gong signal, to be operated from a 110-volt circuit and controlled from a desk in the office 900 ft. distant. In order to avoid the prohibitive cost of running a long conduit line around and through our buildings, we decided to use a small relay operated from a 24-volt, bell-ringing transformer. With this low voltage it was permissible to use two-conductor telephone wire, installed at low cost.

As will be seen from the sketch, when the button at the desk is pushed the relay closes, energizing the light and gong from the 110-volt circuit until the relay circuit is opened by pressing the normally closed button, which is located near the bell.

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Westinghouse has a "Safety Calendar" in which it lists continuous, weekly, monthly, quarterly, semi-annual, and annual inspections.

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Erratic Motor Performance Traced to Compensator

Harry M. Spring, Milford, N. J.

After several years of operation the chain connecting a 75-hp., 440-volt, squirrel-cage motor to a paper pulp machine started to whip, especially under load. Each time it whipped it would strike the guard with sufficient force to be dangerous to nearby workmen.

The first assumption was that the chain was loose; so it was carefully tightened. When this adjustment failed to improve matters the sprockets were slightly shifted along their keyed shafts. A check on the alignment showed that it was correct.

The trouble persisted; so the electrician put an ammeter in each of the motor leads. Two of the leads showed a considerable overload, whereas the third was underloaded. Also, a rapidly fluctuating current was indicated. The oil tank was then removed from the compensator and it was discovered that the contact fingers in the faulty phase were badly burned. There had been a poor contact, with arcing, for some time. It resulted in giving the motor a slight but rapid variation in speed, particularly under heavy load. When this condition was corrected the trouble disappeared.

Such troubles can be avoided by making sure that the contact fingers in compensators receive the proper attention periodically.

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Keeping a Neat Stockroom

Arthur Van Vlissingen, Jr., Chicago

What are known at Abbott Laboratories, North Chicago, Illinois, as finishing supplies are such materials as carton set-ups, liners, and assorted odds-and-ends of this sort. The finishing supplies stockroom has always been difficult to keep neat because many of these supplies simply cannot be stacked in orderly fashion. Circular bundles of liners and the like are inherently mussy.

Recently neatness was attained by changing the method of carrying the stock. Formerly it was stacked haphazardly. Now the larger units, such as bundles of carton set-ups, are piled along the aisle lines. They make a neat outside wall. The small stuff, which cannot be kept in such good order is kept behind these outer walls. Thus the room looks neat; aisles are clear. And frequent inspection by the management assures that the disorder in the rear will not exceed what is unavoidable.

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Inspection Under Glass

Source, Cleveland Home Brewing Company, Cleveland

One of the nicer inspection problems is that encountered in the modern brewery where it is found desirable to examine bottled beer for clearness. The difficulty lies in the fact that the bottles move out of the capping

machine and past the inspector at the rate of 55 a minute —altogether too fast to permit a good job of final inspection without mechanical assistance of one sort or another.

That assistance is provided in at least one brewery by passing the bottles between a light box and a magnifying glass 14 inches in diameter. The box, located on the far side of the bottle conveyor, is equipped with three 400-watt lamps which supply enough light to obtain clear magnification through the glass. By this method, impurities are readily detected, and a quality product is assured.

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By equipping seven oil-burning boilers with CO_2 recorders, a large refinery raised CO_2 content from 8 to 12 per cent, saves $38,000 annually—8½ per cent of its fuel bill.

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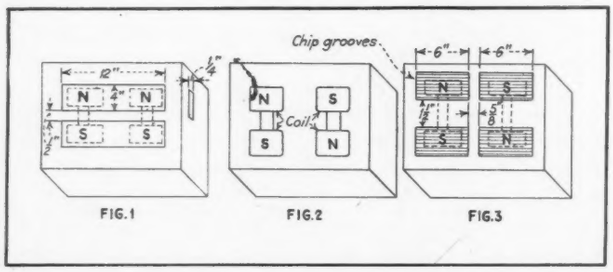

Demagnetizer Strengthened By Redistributing Poles

T. L. Lawson, Foreman of Maintenance
Radio Condenser Company, Camden, N. J.

A new demagnetizer was considered necessary to take care of some large dies that were being made. The one in use was rated 110 volts, 60 cycles, and had two plates with two coils per plate. These coils were connected to give one plate a north pole and one plate a south pole, as Figure 1 shows. However, with the thought that by distributing the poles greater magnetic effect would be produced, the plates were removed from the demagnetizer and polarity of the coils was determined by passing direct current through them and noting the deflection of a compass. The coils were then reconnected to give the arrangement shown in Figure 2. In addition, the plates were cut in halves, chip grooves cut, and respaced as in Figure 3. The chip grooves insure good contact of the work on the plate and the larger dies are demagnetized satisfactorily.

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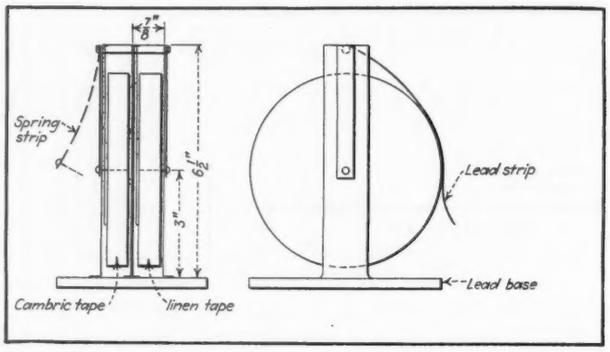
Tape Holder That Saves Time and Temper

J. H. Sauvé, Temiscaming, P.Q., Canada

The sketch shows the details of a convenient device that will hold the two kinds of tape ordinarily used in winding motors. Brass or iron strips can be used for making the frame, which is fastened to a lead base that



is sufficiently heavy to keep the holder from tipping over when the tape is unwound.

Rolls of tape are supported on a pin at the lower end of a strip of spring brass or steel, the upper end of which is attached to the top of the frame. A roll can be inserted or removed by pulling the strip out.

To keep the tape from unwinding beyond requirements, or at the wrong time, a weight in the form of a strip of ⅛-in. sheet lead rides on each roll. The weights are hinged at the top of the frame.

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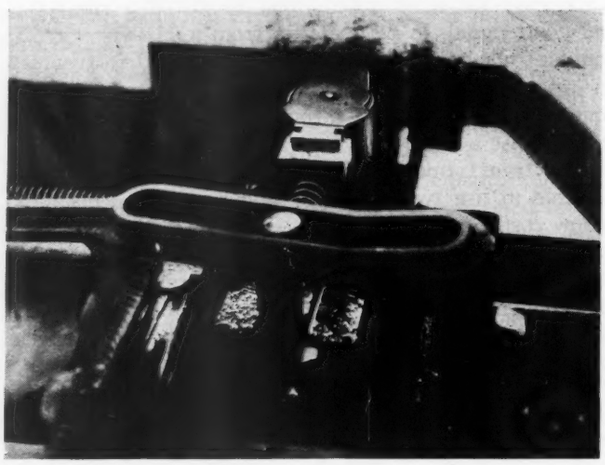

Dated Dentifrice

Source, Bristol-Myers Company, Hillside, N. J.

Coffee is dated. Why not toothpaste? There are good reasons, of course, why any product should be dated, and it is no novelty to uncover examples of the practice.

The novelty here, if any, lies in the manner of the dating. Note that an ordinary date stamp has been rigged up in connection with an automatic sealing machine. As each carton of Ipana moves past, the stamp darts out, as it were, and leaves its mark. Never misses nor blurs, because the stamp moves along with the carton while the two are in contact.

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No machining is required on the frame of one of the newest typewriters. It is a two-piece zinc die-casting.

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· FACTORY FORUM ·

A new question is presented herewith, and readers' discussions of previous questions are published. Write down your opinions and send them to the editor. Answers published will be paid for

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What of Works Councils?

George Shipman and Frank Fulleger stomp their feet, blow their noses, and talk, as they stand at the top of the hill waiting for Frank's kids to get in their quota of coasting.

* * *

"You say there's a lot of talk, Frank. What do you mean—secret talk? Talk about going after their rights, and so on? I always thought that your people were well satisfied."

"They were, until the air became full of the collective bargaining germ. And they're even better off now—some of them, at any rate, as a result of NIRA. I can't explain it, unless they've been approached by agitators."

"Of course that might have something to do with it, but in my humble opinion an agitator has a hard row to hoe if he goes up against a background of long years of fair treatment. It occurs to me that possibly the grapevine has carried some stories about the Works Council that your management is considering."

"You don't mean that might cause trouble, do you, George? So far as I know there has been no attempt to keep the talks about the Works Council a deep secret. And I happen to know that the old man considers the right kind of Works Council something good for employees, not against them."

"Frank, I don't question his motives for a minute. But take a look at the other side of the fence; maybe the employees have the same kind of feeling about their own proposed organization—if one has been proposed. The old man undoubtedly feels that there is no need for such an organization after all these years of getting along well. And it's just as likely that employees wonder what the old man is up to with a Works Council now if he didn't need one before."

"You think that maybe both factions are merely digging in, eh, George? Building up a defense—in case?"

"Something like that. And of course both sides are asking themselves some questions. For example, if we have a Works Council, is a Union necessary? If we have a Union, is a Works Council necessary? If we have both, can they work together?"

"And what are the answers, George?"

That's what we'll have to figure out later. I see the kids—time must be up."

* * *

They start home, with the kids on their sled behind Frank's car. We still have the questions:

Are Works Councils desirable? Can they and Unions operate successfully at the same time in the same shop? Can Works Councils be effective if they avoid discussing wages and hours, the two matters that most intimately concern employees?

•

ANSWERS TO PREVIOUS QUESTIONS

How Big Is Maintenance Now?

(Question presented in the November issue)

THE QUESTION "How Big Is Maintenance Now?" will be more appreciated if it is restated in this manner: "Of what importance is the problem of maintenance in a productive enterprise and what factors govern its activity?"

One of the ultimate purposes of the NIRA is to place industries on a paying basis in order that each man, woman, and child will be directly benefited by the necessarily increased productivity. It is to be noted that labor costs and costs of materials and supplies have shown a marked increase. In order to offset these items, which would naturally increase the cost price of a manufactured article, there has been a tendency to investigate such production problems as the redesign or scrapping of ob-

solete equipment, time and motion study, job study, reorganization of actual labor, improvement of the finished product to increase its salability, with the purpose of producing a more satisfactory article from the consumer's point of view at a non-prohibitive cost price.

The results of investigations in production problems lead to a greater activity in the maintenance division. Time study, motion study, and job study bring to light costly production faults, whether they be a direct result of inefficient handling of materials, poor workmanship, obsolete machinery and equipment, unbalanced floor space, or improper departmentalization. It is the function of the maintenance division to redesign old equipment, obsolete machines, inefficient buildings, and to keep up running repairs. Increased activity of the production control division, resulting in recommendations for change of obsolete machinery and equipment, change of product design, and resulting in increased overall productivity, will provide greater activity for the maintenance division. Increased maintenance results in increased expenditures for maintenance purposes. A careful study of budgeting in order to control these expenditures and keep work at its maximum efficiency will do its share to regulate and to produce a non-prohibitive cost price.

CARL ENDLEIN, JR., *President*
Endlein Engineering Corporation
New York

More or Fewer Records?

(Question presented in the August issue)

THE QUESTION of more or fewer records involves a study of the existing records in an organization to determine whether each record is serving a useful purpose, and whether the cost of that record is warranted.

In determining the value of any record to an organization, a careful line must be drawn between essential facts and "Information that is nice to have."

An organization lacking proper records functions as a ship without a rudder. Accurate records are necessary to locate quickly every piece of stock or equipment in a plant. Costly delays and loss of productive capacity are encountered when machine operators or assemblers are held up because certain equipment or parts of assemblies cannot be located quickly.

Accurate records are necessary for the elimination of guess work in management. Information must be readily obtainable on important and basic factors pertaining to the work of any organization to permit management to make a proper study of trends and costs. Quick, accurate information is also necessary for the construction of bases for decisions management must make with regard to economic trends and divisional budget performance.

G. W. WELLES
Production Department, Brantford Division
Massey-Harris Company, Limited
Brantford, Canada

ACCURATE, up-to-date records are essential in every phase of plant operation, and their use cannot be under-estimated, but, like every production and maintenance tool, they should be subject to scrutiny from time to time as improved methods suggest their elimination or replacement.

I have in mind a concern of my acquaintance, which recently instituted a plant records survey as part of a renovation program. When the dust of several weeks of intensive work had subsided, it was found that their labors had not been in vain. By the careful weeding out of unnecessary detail paper work, in line with the latest methods of plant records control, a saving of twenty per cent in clerical time and money was effected.

ROBERT S. ALEXANDER, *Special Department*
Universal Winding Company, Providence, R. I.

What of Cost-Cutting Equipment Under the NIRA?

(Question presented in the September issue)

THERE is no doubt that cost-cutting equipment, over a period of years, has caused a vast increase in potential and actual production with an attendant decrease in man hours necessary for a definite production quantity. It is also true that humanity is at present suffering because there is a surplus of man hours due to economic forces and lack of purchasing power and that there is a general feeling among certain people that the energy devoted to cost-cutting equipment should be given a holiday.

This feeling is predicated on the obsolete hypothesis that putting men back to work by cutting down the productivity per man is a healthful condition.

Cost-cutting equipment has done more than any other one factor to place so-called luxuries within the price range of the average person. In doing this, however, it is inevitable that the necessary man hours for any specific production quantity will be less. Should we then, as suggested by Frank, stop the movement which has produced such immeasurable benefit? The answer is obviously no, as it is a step backward which will eventually destroy the very forces of initiative which have ceaselessly forced our plane of existence higher and higher. It would be just as foolish to suggest that we discontinue airplane design experiments because men will be killed during the experimental stage. All progress which has benefited mankind has been associated with local discomforts. Who would return to the use of the 1910 automobile as against the 1933 type, which has been made available largely by cost-cutting equipment, even though he knows that fewer workmen are necessary per automobile? The actual result, as everyone knows, has been an enormous increase in consumption which has absorbed back into the industry many times the number originally made jobless by cost-cutting equipment.

The condition today, which badly needs remedying, cannot be charged to cost-cutting equipment, but is largely a result of the failure of the forces of consumption. Limiting production to apparent consumption should be considered only as a temporary expedient. Increasing consumption to increase production is the right method.

GEORGE ALLISON, *Assistant Works Manager*
Mergenthaler Linotype Company, Brooklyn, N. Y.

Dual-Voltage Connections for Induction Motors

Three-phase delta series and parallel connections, twenty to twenty-four poles

(Continued from the November issue)

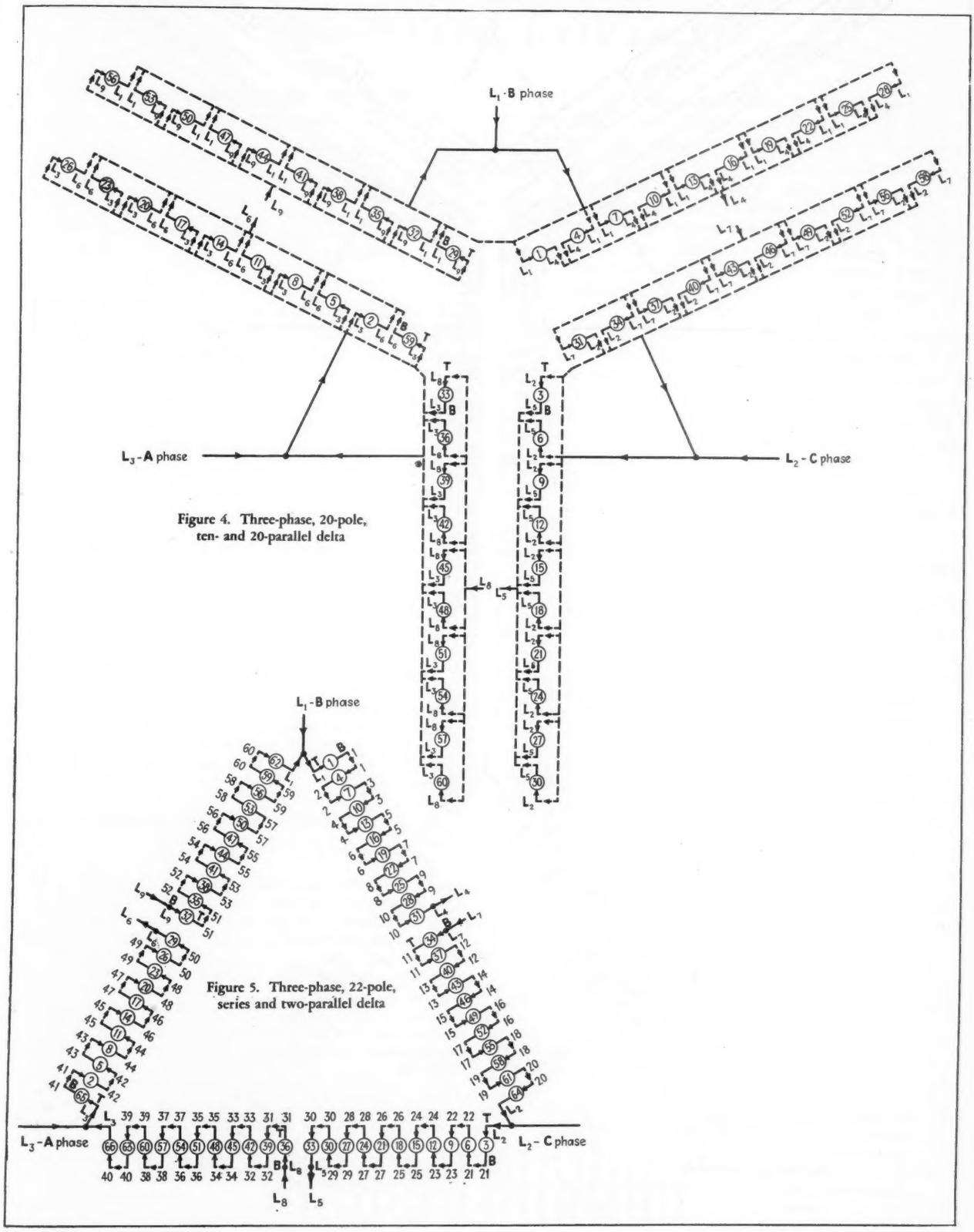


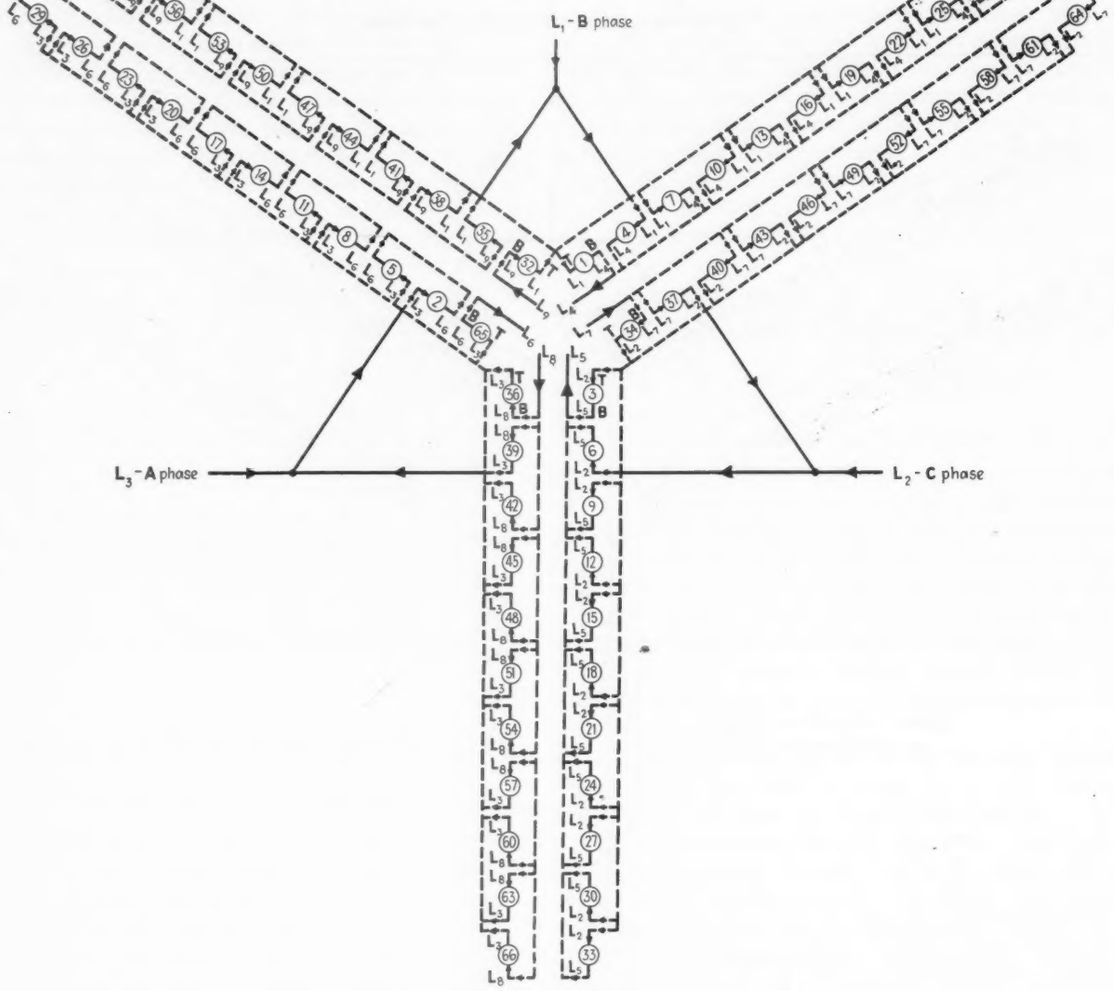
Figure 4. Three-phase, 20-pole, ten- and 20-parallel delta

Figure 5. Three-phase, 22-pole, series and two-parallel delta

(Continued on the following page)

(Continued from preceding page—to be concluded)

Figure 6. Three-phase, 22-pole, eleven- and 22-parallel delta



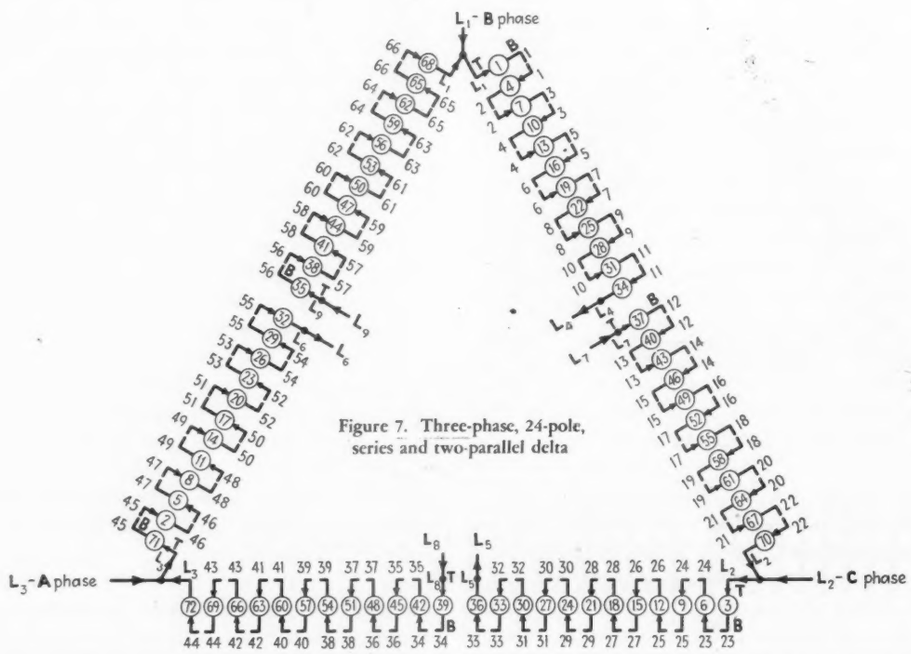


Figure 7. Three-phase, 24-pole, series and two-parallel delta

QUESTIONS and ANSWERS

Conducted by G. A. VAN BRUNT

Checking Motor Loads by Kilowatt-Hour Meter

I want to check up the loads on some of our circuits and motors, but am hampered by the lack of instruments. It is possible, so I have been told, to do this by means of the kilowatt-hour meter on the switchboard. Will someone please tell me just how to do it? *T.M.K.—Nashville, Tenn.*

THIS TEST can be made very easily and the results obtained will be quite accurate, particularly where the load fluctuates so much that difficulty in reading indicating-type instruments leads to uncertainty.

It is assumed that the meter is of the three-phase type. If the revolutions per minute under full load are known it is necessary merely to count the revolutions at the load and determine the proportion of the full-load capacity. Assume that the meter is of the two-element type, rated at 110 volts, 5 amp., and has a full-load speed of 25 r.p.m. The capacity in kilowatts is $(100 \times 5 \times 2) \div 1{,}000$, or 1 kw. If at the load under test it revolves 20 r.p.m., the load is $20/25 \times 1$ kw., or 0.8 kilowatt.

When current and potential transformers are used the test results should be multiplied by the product of the two ratios. Assume 100:5 ratio for the current transformers and 2,200:110 for the voltage transformers. The two ratios are each 20:1 and the combined ratio would be 20×20, or 400:1; hence, the actual load on the circuit is 0.8×400, or 320 kilowatts.

The full-load speed of the meter may be obtained from the manufacturer, or it may be calculated if the testing constant is known. This constant usually is marked on the case or dial of the meter, or it may be obtained from the maker. Assume that the meter has a capacity of 1 kw., and has a test constant of 2/3. The full-load speed will then be:

$(1{,}000 \times 60) \div (2/3 \times 3{,}600)$, or 25 r.p.m.

(Continued on advertising page 34)

ANSWERS WANTED

Locating Grounded Coils in Motor

When an insulation resistance test shows a ground to the frame on one phase of a three-phase motor, what is the best or quickest method of locating the defective coil? How can a short between phases best be located? *P.J.—Chicago, Ill.*

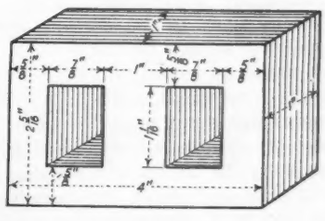
Allowing for Development Expense in Maintenance Costs

Answers by Messrs. Baumbach and Scribner on page 472 of the November issue, in reply to H.E.W.'s question, bring up another matter in connection with the attempt to set up a departmental maintenance budget.

Our methods, machinery, and packages constantly are changed as improvements in production are developed. This constant changing means expense in development of ideas, breaking in new machinery, and experimenting with new methods. In order to keep down capital expense it is the practice of most firms, I believe, to absorb as much as possible of the development outlay in current operating expenses. If such expenses, which originate with the management, are a considerable part of the total maintenance expense of a department the control of the foreman over the maintenance burden of his department is noticeably affected.

Our production departments are working under a premium system based on time studies. Our maintenance departments are also operating on a premium system, but it is based on past costs of each maintenance department, considering the production of the plant as a whole. We wish to find some way to tie in maintenance costs in each department with the supervision premium, but the condition mentioned above makes us doubt the fairness and practicability of such a tie-up. How have other readers solved this problem? *H.E.S.—Battle Creek, Mich.*

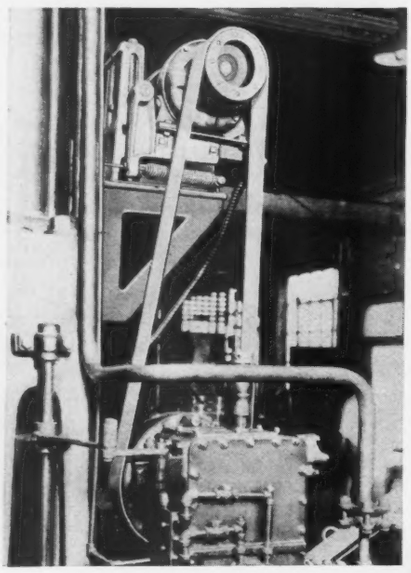
Winding Data for Transformer



What size of wire and how many turns should be used in the primary and secondary of the transformer core shown in the sketch? The primary will be operated at 110 volts, 60 cycles. I want to obtain 4, 5, 6, 7, 8, 9, 10, 11, and 12 volts from the secondary winding, which will have a load of 3 amperes.

D.A.M.—Youngstown, Ohio.

·EQUIPMENT NEWS·



Motor Drive Bases

Two types, Ceiling Drive and Vertical Drive. The first is said to give to ceiling drives the same range of tension adjustment obtainable with Rockwood floor-mounting bases, but with more convenient adjustment. The ceiling-drive base is similar to the standard base, except that it has special hanger arms which suspend the motor horizontally, and give greater clearance from the ceiling.

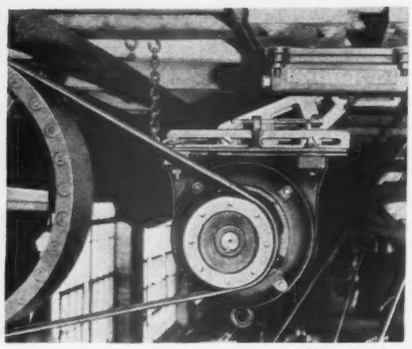
Adjustable steel angles, which move horizontally on the hanger arms, are supported by a ledge cast on the bottom of the hanger arms, which carries the weight of the motor, taking it from the slotted-head screws in the arm slot. Aside from adding strength to the motor support the ledge permits the screws to be loosened and the adjustable angles to be moved along the ledge by turning the secondary arm-screws while the drive is running.

The auxiliary pair of screws on the hanger castings serve to move the motor relative to the pivot shaft, without having to support the motor weight independently while the change is being made. It is necessary to loosen the screws in the arm slots and move the motor forward or backward, depending on the tension desired, by means of the adjusting screws on the arms. After this has been done, the screws in the arm slots are tightened and the nuts on the pivot shaft screws are turned until the arms are brought back to horizontal.

The vertical-drive base has been designed to eliminate the trouble from slipping of belts commonly encountered on vertical belt drives, by providing for and maintaining correct belt tension for both pulleys. It differs from the standard horizontal drive base in that the force producing belt tension is derived from coiled springs, rather than from the weight of the motor. Otherwise it is much the same in both principle and operation.

When the motor is located above the driven pulley the springs are adjusted to support the entire motor weight plus the necessary belt tension. When the motor is mounted below the driven pulley the springs are adjusted to support only that portion of the motor weight that is not needed to provide belt tension.

Belt tension may be changed to accommodate different operating loads,



by turning the two nuts at the ends of the coil spring rods.

To simplify the location of the motor relative to the belt length at the time of installation, and to provide adjustment for elongation of the belt in service the pivot shaft is movable vertically by means of adjusting screws which also aid in securing alignment of the two pulleys, so that the belt will track. The Rockwood Mfg. Co., Indianapolis, Ind.

Switch

Oil-immersed, magnetic, designated as CR7006. For use in corrosive atmospheres where Class I, Group D is not required. Designed for controlling motors started on full voltage. Consists of standard GE magnetic switch with special coils and contact tips for operation under oil. Three sizes: 3 hp. at 110 volts, 5 hp. at 220 volts, 7½ hp. at 440 and 600 volts; 7½ hp. at 110 volts, 15 hp. at 220 volts, 25 hp. at 440 and 600 volts; 15 hp. at 110 volts, 30 hp. at 220 volts, and 50 hp. at 440 and 600 volts. General Electric Co., Schenectady, N. Y.

Drill

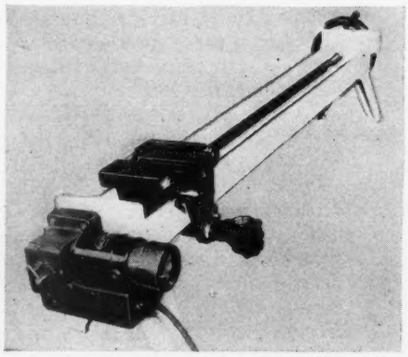
Three-point, masonry, known as Rawldrill. Three-point construction claimed to permit resharpening of drill on any grinding wheel, on the job. Cutting lips have straight parallel sides. Hand forged from tool steel. In several types for hand and power drilling. Sizes from ⅜ to 1⅜ in. diameter, varying lengths. The Rawlplug Co., Inc., 98 Lafayette St., New York.

Switchgear

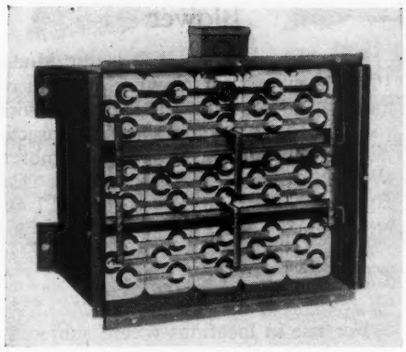
Metal-clad, 7.5 kv. Top-entrance connections, side-entrance cable terminators. Each steel-inclosed unit consists of two parts: stationary element with busses and accessories, and a removable oil-circuit-breaker element of vertical lifting and lowering type. Interlocks so arranged that breaker can be operated only in fully connected or disconnected position. Before breaker can be raised or lowered it must be tripped. Mechanically held in open position during vertical travel. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

Cutting Machine

Oxweld, Straight-Line. Consists of steel-channel supporting base, means for moving blowpipe, and adjustments for setting blowpipe to cut bevels. Motion in two directions, 45 in. longitudinally, 7¾ in. laterally. Can be furnished with two hand wheels for hand operation, or with one hand wheel and 110-115-volt universal motor. Linear speed range up to 33 in. per min. Governor graduated in inches per minute for setting speed. Reverse switch permits motion



in either direction. Roller springs keep gears in mesh and carriage steady. Machine is portable, but has bolt-holes for fastening to permanent support. The Linde Air Products Co., 30 E. 42d St., New York.



Capacitors

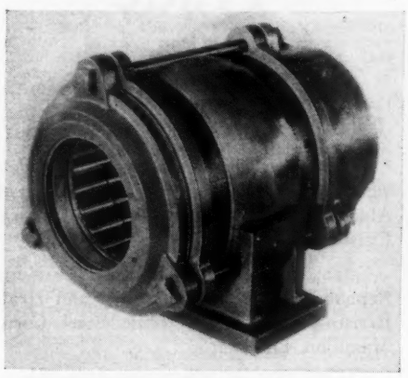
For power-factor correction. Unit-type construction. Consist of small independent hermetically sealed can units. Box type furnished in welded sheet-steel cases with weatherproof covers, suitable for indoor or outdoor service. Rack type, in sizes over 30 kva., supplied in weatherproof housing or with steel screen inclosures. Both types made for all voltages up to 4,600 for any frequency and phase arrangement, in any size desired. The Ideal Electric & Mfg. Co., Mansfield, Ohio.

Tractor

Gas. Called "Banty." For hauling industrial trailers. Weight 2,700 lb. Length 73½ in., width 40 in., height 56 in. No-load speed, 7½-8 miles per hour. Engine, 4-cylinder Waukesha, rated 16.9 hp. Full pressure lubrication. Self-starter. Thermo-syphon cooling. Single-disk 9 in. dry-plate clutch. Three speeds forward, one reverse. Three wheels, rubber tired. Gravity-feed, 3-gal. fuel tank on dash. Mercury Mfg. Co., 4118 S. Halsted St., Chicago.

Bearing

Roller, for industrial applications. Consists of conventional inner and outer rings and roller-cage assembly. For heavy-duty service. Rolls high-carbon chrome steel. Cage of form-rolled spacer-bar stock with carburized and hardened end rings. Rollers held in place by spacer bars riveted to end rings. Bearing sizes from 3½ to 7⅞ in. shaft diameter. Pillow block application, shown, has standard single-roll radial ball bearing in place of usual bronze-plate thrust carrier to take care of thrust loads in either direction. The Fafnir Bearing Co., New Britain, Conn.



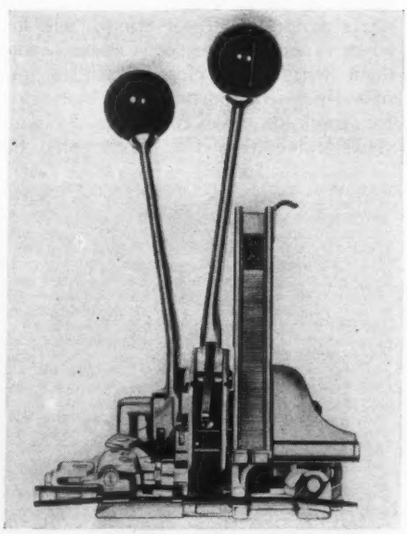
Lamp

"Three-Light." Contains two filaments for producing three different wattages. Mazda 150-200-watt lamp in PS-35 bulb will consume 150, 200, or 350 watts. The 200-300-watt in PS-40 bulb will consume 200, 300, or 500 watts. Both lamps inside frosted, operate on 110, 115, or 120 volts. Mogul screw base has two bottom contacts, an eyelet and a ring, to permit use of either filament alone or both at once. Westinghouse Lamp Co., Bloomfield, N. J.

Turbine-Gear Reducer

Close-coupled. Designed for driving centrifugal pumps, fans, other low-speed apparatus. Self-lubricated. Housings of turbine and reducing gear bolted together to form single structure supported on turbine base. Turbine can be operated at steam pressures up to 400 lb., temperatures up to 750 deg. F., back pressures up to 40-lb. gage. Speed of low-speed shaft, 180 to 3,000 r.p.m. Capacity from 10 to 150 hp. General Electric Co., Schenectady, N. Y.

Packaging Device



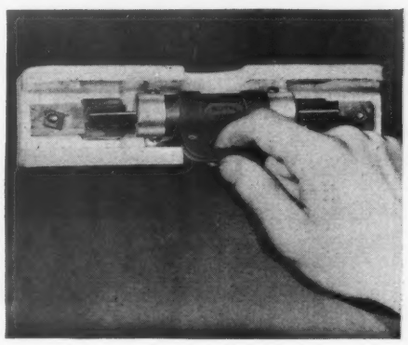
Called "Steelstrapper." For reinforcing wood and fiber boxes with straps. Tensions strap, applies seal, seals joint, cuts strap from coil. Controlled by two ball-tipped levers. Automatic seal feed. Acme Steel Co., Chicago.

Pumps

Double-suction, split-case, centrifugal. Suitable for direct connection to motors or turbines operating at 3,500 r.p.m. May also be belt-driven or gear-operated from low-speed drivers. Ball bearings for radial and thrust loads. Sizes from 1½ to 5 in. For general pumping duty, factory service, chemical process work. Morris Machine Works, Baldwinsville, N. Y.

Fuse

Cartridge, with insulated handle for removal when blown. Handle is fastened around fuse, turns freely for



insertion and removal at any angle. Fuse pullers unnecessary. Fuses N.E.C. standard. Royal Electric Co., Avon, Mass.

Dumbwaiter

Fully automatic, undercounter type. For conveying materials, parts, products from one floor to another. Car raised and lowered by threaded vertical steel column. Column driven by nut connected to motor through double V-belt. Automatically controlled from either floor by push buttons. No ropes, cables, or pulleys. Will lift 300 lb. Made in two standard sizes. The Warner Elevator Mfg. Co., Cincinnati.

Globe

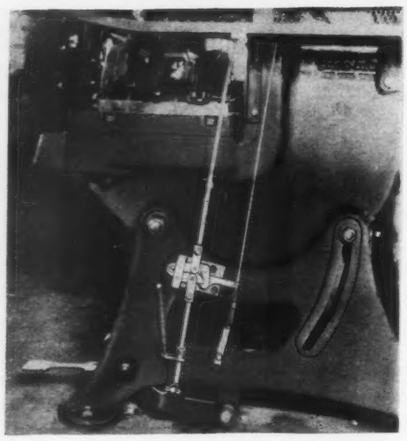
Shell, for floodlighting at close range. Front of globe is clear glass, remainder coated with fired-on finish of ceramic enamel which acts as reflecting surface and as diffuser for small amount of light passing through rear. Lamps as high as 10,000-lumen rating may be used. General Electric Co., Schenectady, N. Y.

Hoist

Electric, twin-hook type. For lifting long and bulky loads requiring handling from two points. May be rigidly suspended or carried from trolley on monorail track. Capacities from 500 to

6,000 lb. Electrical equipment for d.c., polyphase a.c., or single-phase a.c. operation. Two drums, operating together, are mounted on extended drum shaft of any desired length. Single-worm drive. Anti-friction bearings. All gears and bearings operate in grease bath. Automatic positive stop. Rope or automatic push-button control. ElectroLift, Inc., 30 Church St., New York.

Safety Device



Non-repeat for punch presses of all sizes. Working parts of case-hardened steel and bronze. In action, device separates clutch rod, making repeat impossible. American AllSafe Co., Inc., 71 West Huron St., Buffalo, N. Y.

Motor

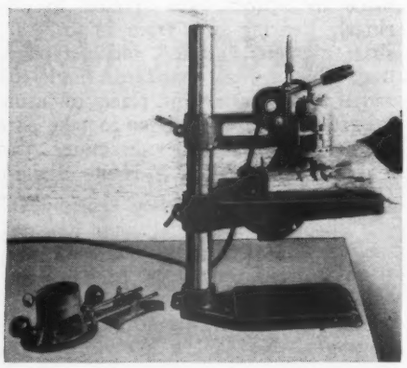
Single-phase, with built-in capacitor and automatic centrifugal cut-out switch. Capacitor, coil-wound without sharp turns, is air-cooled. Available sizes from ⅓ to 3 hp., horizontal or vertical. Other sizes to be added. The Louis Allis Co., Milwaukee, Wis.

Drafting Instrument

"Wrigraph Draft Block." For use in field, on train, in office. Consists of $\frac{3}{16}$-in. Masonite board, with paper clips for holding single sheet or pad of letter-size paper, and parallel device with drawing attachments. L. G. Wright, 9120 Fuller Ave., Cleveland.

Router and Shaper

Electric, for woodworking. Interchangeable power unit, 110-volt universal motor with provision for mounting either router chuck or shaper spindle directly on armature shaft, operates at 18,000 r.p.m. Shaper unit has tilting motor-unit holder to permit use of small-diameter cutters for molding cuts, give variety of contours with limited number of cutters. Hand router, bench



router, or bench shaper may be had separately or together. Stanley Electric Tool Co., Dept. F, New Britain, Conn.

Skin Protector

Called "Skin-Gard." Consists of a cream, designed to be rubbed into hands at start of work, said to form protective film that prevents dirt and infection from reaching skin. Removable with warm water. Magnus Chemical Co., 14 South Ave., Garwood, N. J.

Spray Cleaning Device

Called "Hypressure Jenny." Model D. Like earlier models in construction. Electric-motor driven. Operates on light current. Fuel-oil burner for heat generation is pressure-atomizing type. Ignition by automatic electric spark. Rotary solution water and fuel-oil pumps, direct-connected to ¼-hp. motor. Saturation selector gives any degree of vapor saturation from heavy cutting spray to light mist. Nozzle control starts motor, generator pumps, and fire when vapor-outlet valve is opened, stops them when it is closed. Entire unit fully inclosed, portable or stationary for truck or floor mounting. Homestead Valve Mfg. Co., Coraopolis, Pa.

Blower

Portable, electric. "Tornado Model 10" is designed for blowing dust out of motors and machines, parts, bins, stock rooms, etc. Also for spraying insecticides. Has 1-hp. ball-bearing motor. With fan, gives 46½-in. water lift. The Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago.

Lamp

For use in locations where subject to intense vibrations. Special wire ring-type filament held by six filament supports. Flexible spring wire supports glass arbor, enabling entire mount to vibrate freely without undue strain on filament, supports, leads, or other members. Made in 100-watt size, frosted. Hygrade Sylvania Corp., 500 Fifth Ave., New York.

Stapler

"Crofoot Featherweight." For attaching tags to boxes and other cartons. Rust-resisting metals used throughout. Plunger slide lubricated by oil wicks. Working parts inclosed to prevent entry of grit. Four times faster than previous models. J. B. Crofoot Co., Mount Prospect, Ill.

Valves

High-pressure, needle. Carbon-steel or "Exelloy" (high chrome, stainless iron). Particularly adaptable to high-pressure gage lines on oil service. Crane Co., 836 S. Michigan Ave., Chicago.

Cabinet

Metal, for use in office. Called "Secretaire." Five models, four standard finishes. Contain filing drawers, lockers, typewriter accommodations, compartments with combination locks. The General Fireproofing Co., Youngstown, Ohio.

Trade Literature

ALUMINUM—Two Booklets, "The Riveting of Aluminum," and "The Welding of Aluminum."—Aluminum Co. of America, Pittsburgh, Pa.

CHROMIUM STEELS—Booklet "Enduro, Republic's Perfected Corrosion- and Heat-Resisting Alloys."—Republic Steel Corp., Massillon, Ohio.

(Continued on advertising page 38)

Data Sheet

The Goodrich Cooperative Plan

PURPOSE

IN ORDER to provide a means of promoting closer relations between the Employees and the Management of this Corporation, to provide a method for the prompt consideration of any problems that may arise, and to provide a means whereby Employees shall have representation and collective bargaining in the consideration of questions relating to working conditions, hours of labor, wages, safety, and other matters of mutual interest, the Goodrich Cooperative Plan is herewith set forth and will be operated as hereinafter provided.

This plan shall in no way discriminate against any Employee because of race, sex, or creed, or abridge or conflict with his or her right to belong or not to belong to any lawful society, fraternity, union, or other organization.

STRUCTURE

No. 1—Employees who can qualify as voters, shall elect Representatives annually by a method and on a basis of apportionment hereinafter described.

The Representatives of each major Division of the Corporation, when once elected, shall be known as the General Committee of that Division.

No. 2—The Representatives, known as the General Committee, shall elect a President, a Vice-President, and a Secretary of the General Committee, a Chairman and four members of a Wage Committee, and a Chairman and four members of a Welfare Committee.

No. 3—The Wage Committee will handle all problems pertaining to hours of work, rates of pay, and matters affecting earnings. These shall include wages, piece rates, work distribution, inequalities of rates, premium payments, and similar matters.

The Welfare Committee will handle all problems pertaining to working conditions, health, safety, recreation, Community Fund, Employees' Insurance, vacations, seniority rights, pensions, and similar matters.

No. 4—At the same time these committees as elected, Management will appoint two Management Representatives, on of whom shall work in conjunction with the Wage Committee, and the other with the Welfare Committee. The Management Representative will meet with his respective committee at the committee's request and act in a consulting and advisory capacity. All matters which have been referred to the Wage or Welfare Committees shall be presented to the proper Management Representative for his recommendation thereon prior to being referred to the Joint Committee.

No. 5—The Joint Committee of each Division shall be composed of six persons —namely, the President of the General Committee of Representatives, the Chairman of the Wage Committee, the Chairman of the Welfare Committee, and three members appointed by Management.

The Chairman of this Committee shall be the President of the General Committee, and the Secretary shall be chosen from the three Management members.

No. 6—The Appellate Council of the entire Corporation shall consist of the Presidents of the various General Committees and an equal number from Management, but not more than one Management member shall be appointed from each major Division.

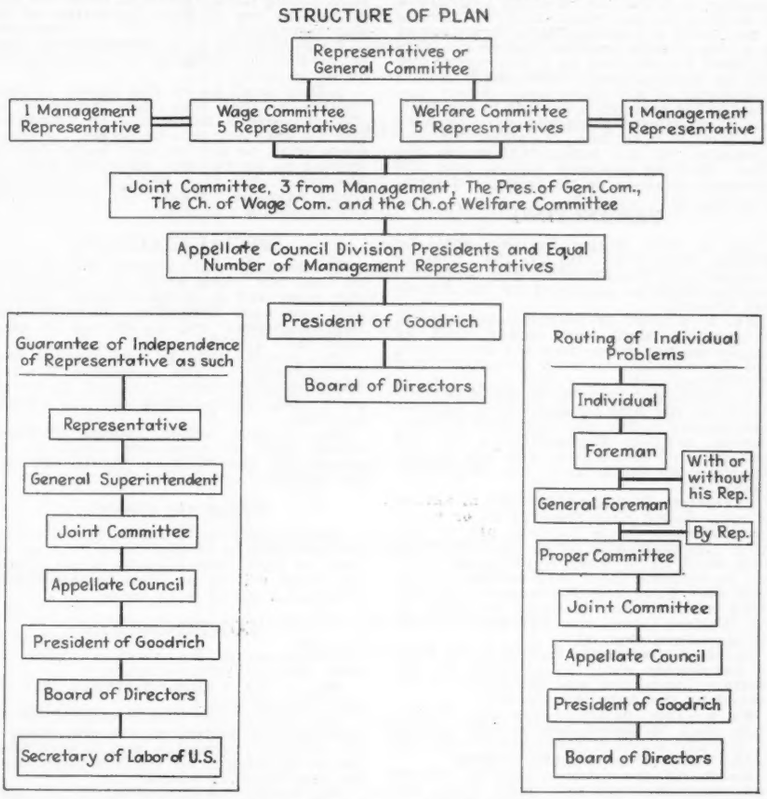
It will be the duty of the Appellate Council to take any problems which they cannot settle to the President of this Company, and from him to the Board of Directors, if necessary.

The Chairman of the Appellate Council shall be an Employee, chosen by and from the Employee members of the Appellate Council. The Secretary shall be a Representative of Management, selected by and from the Management members of the Appellate Council.

OPERATION PROCEDURE

No. 1—Any problem involving an individual only shall be taken up by the individual Employee with his immediate superior, then, if necessary, with his Representative. The Employee, or the Employee with his Representative, or the Representative, whichever the Employee prefers, will, if necessary, carry the matter through the other superiors to the General Foreman.

The Goodrich Cooperative Plan Typical Division Chart



No. 2—It is understood that any problem handled by a Representative must be reduced to writing.

No. 3—If the problem is not yet settled to the satisfaction of the Employee, his Representative, and the Employee, if the Employee so desires, will present it to the President of the General Committee who will assign it either to the Wage or Welfare Committee to whom it will be presented by the Representative.

No. 4—If the Employee so desires, the matter may be successively referred to the Joint Committee, the Appellate Council, the President of the Corporation, and to the Board of Directors.

No. 5—When a problem concerns a group of Employees, it shall be reduced to writing and the group, or any number of them, may go to their Representative and state their case.

No. 6—The Representative shall then arrange a hearing, if so requested, for one, two, or three spokesmen, with the Foreman, General Foreman, or other persons qualified to hear the problem.

No. 7—If the problem is not settled, the Representative and spokesmen shall take it to the President of the General Committee, who will assign it either to the Wage or Welfare Committee, to which it will be presented by the Representative.

No. 8—If the group so desires, the matter may be successively referred to the Joint Committee, the Appellate Council, the President of the Corporation, and to the Board of Directors.

No. 9—If the Management has a problem they wish to present to the Employees, they may present it through their Representative to the Wage or Welfare Committee of the Division or Divisions.

No. 10—The Committee to which the problem is referred will take the problem up to the other Committees or directly to the Representatives depending upon its nature, and report back to the Management through the Management Representative.

No. 11—If, in the judgment of a Representative, any individual or Committee is taking an unnecessary amount of time in solving a problem, the Representative may, after duly notifying the individual or Committee, take the matter farther as herein provided.

QUALIFICATIONS OF VOTERS

In order to qualify as a voter, the following requirements must be fulfilled:

No. 1—There shall be no restrictions barring any Employee from voting on account of race, creed, or nationality.

No. 2—An Employee must have been enrolled on the records of the Company prior to April 1st of the election year in order to vote.

No. 3—A person in a supervisory capacity, or one who has the power to employ or discharge, shall not be eligible to vote or hold office as Representative or Committeeman.

No. 4—Only Employees on an hourly rate shall be eligible to vote and hold office as Representatives and Committeemen in the Factory Divisions.

Exception: Members of the Plant Protection Department not in a supervisory position may elect Representatives, but these Representatives shall not hold office in the General Committee or be members of the Wage or Welfare Committees.

QUALIFICATIONS OF REPRESENTATIVES

No. 1—Any candidate for office shall be at least 24 years of age, prior to election day.

No. 2—All candidates for office shall have two years of continuous service credit immediately prior to election day.

No. 3—A candidate for office shall be a native born or a naturalized United States citizen, and shall be able to read and write the English language.

No. 4—A Representative, once elected, shall serve his precinct during his term of office even though he may be transferred to another department or precinct, unless a majority of the voters in his pre-

Data Sheet

The Goodrich Cooperative Plan

cinct, within one week of the date of his transfer, petition the Welfare Committee in writing for his resignation.

No. 5—If a Representative is promoted to a supervisory position during his term of office, his services as a Representative will be automatically terminated, unless a majority of his constituents within one week of his promotion present to the Welfare Committee a petition in writing asking him to continue in office for the remainder of his term. Otherwise the office shall be declared vacant and the Alternate shall serve the unexpired term.

PRECINCTING

No. 1—Each major Division shall be divided into precincts by the Welfare Committee of the Division, and such precincting shall be approved by the Appellate Council.

No. 2—Except as hereinafter provided, no precinct shall have fewer than 50 Employees nor more than 124 Employees, and Representatives shall be apportioned as follows:

A department may have one Representative for the first 50 Employees, another Representative for the next full 75 Employees, another Representative for the next full 100 Employees, and one Representative for each full 100 Employees thereafter.

Exception: If a group or craft of skilled or semi-skilled Employees of 25 or more, but less than 50 in number, are so isolated geographically or by the nature of their work as to make it extremely difficult to combine them with another group, they may have one Representative, provided such special grouping is made by the Welfare Committee and approved by the Appellate Council.

No. 3—Departments having fewer than 25 Employees shall be grouped by the Welfare Committee, and the grouping approved by the Appellate Council.

No. 4—The numerical size of a department shall be determined by the number of actually enrolled Employees according to the Labor Department's records.

No. 5—Of the thirteen elective officers and committeemen not more than two shall be elected from one department.

If the three high persons are from one department, for example, the third highest shall be eliminated and the next highest person or persons from another department shall be declared elected.

ELECTIONEERING

No. 1—No one in a supervisory capacity shall be allowed to do any electioneering for or against any candidate.

No. 2—All electioneering by candidates or their friends shall be done under rules made by the Welfare Committees and approved by the Appellate Council.

NOMINATIONS

Nominations shall be made by a simple form of primary to be held on the second Wednesday in April. Each Employee shall write the name of one nominee for each Representative to be elected on a blank ballot and deposit it in the ballot box on the designated day. The three Employees receiving the highest number of votes shall be nominated for each Representative office. The election ballot in each department or precinct may carry three times as many names of nominees as there are Representatives to be elected, plus blank spaces for the writing in of names.

Primary elections shall be conducted by the Welfare Committee under rules and regulations approved by the Appellate Council.

TIES

In case of a tie following the election of Representatives or Committeemen, the senior Employee in point of service shall be declared elected.

ELECTIONS

General Elections shall be held annually on the third Wednesday in April.

Polls shall be open during such hours as may be necessary to give everybody an opportunity to vote as determined by the Welfare Committees.

There shall be two election clerks for each voting place appointed from the Employees by the Welfare Committee of the Representatives.

A Representative of Management shall be present at elections to act in an advisory capacity.

Ballots shall carry the names of candidates so that only the placing of an "X" opposite a name will be necessary, and all balloting will be secret. A blank space shall be left on each ballot for the writing in of names. Elections shall be conducted by the Welfare Committee under rules and regulations approved by the Appellate Council.

SPECIAL ELECTIONS

No. 1—A special primary election shall be held one week after the adoption of this plan, and a special election shall be held one week thereafter, at which time Representatives will be elected to serve until May 1, 1934.

This special primary and election shall be conducted by the respective Drafting Committees of each Division along the same lines as provided for the regular elections.

No. 2—Any other special elections, which may be necessary, shall be arranged by the Welfare Committee with the approval of the Joint Committee.

TERM OF OFFICE

Representatives, Officers, and Committeemen shall be elected for a term of one year, or until their successors are chosen, but there will be no limit to the number of terms a person may serve.

COMPENSATION

Compensation for services under this plan shall be paid as follows:

No. 1—To a Representative, $15 per calendar month.

No. 2—To the Vice-President of the General Committee, to the Secretary of the General Committee, and to each Member of the Wage and Welfare Committees, $20 per calendar month.

No. 3—To the Chairman of the Wage Committee, and to the Chairman of the Welfare Committees, $25 per calendar month.

No. 4—To the President of the General Committee, $30 per calendar month.

No. 5—A Representative serving as a Committeeman or Officer shall be entitled to receive only one salary compensation.

No. 6—A Representative shall receive, in addition to the amounts stipulated, compensation for the time spent in attending an approved or regular Committee meeting held during his regular working shift and necessitating his absence from work. The amount of this compensation shall be at the rate of 75c. per hour.

ALTERNATES

It is recognized that Representatives and Committeemen may necessarily be away from the plant for several days, during which time there may be business for such Representatives or Committeemen to handle. The second high man in the General Election in a precinct shall be an Alternate Representative for that precinct, and the second high man or men in a Committee election shall be Alternate Committeemen and they shall serve during the absence of the regular Representative or Committeeman.

VACANCIES

No. 1—In the case of a vacancy affecting any Representative, the Alternate shall serve the unexpired term.

In case the Alternate is not available, the Welfare Committee shall arrange for a special election to fill the vacancy as herein provided.

No. 2—In case of a vacancy in the office of the President of the General Committee, Vice-President of the General Committee, Secretary of the General Committee, Chairman of the Wage Committee, Chairman of the Welfare Committee, Member of the Wage Committee, or Member of the Welfare Committee, a special election shall be held by the General Committee to fill the vacancy.

RECALL

The procedure for impeaching and recalling a Representative shall be as follows:

No. 1—A petition stating the reasons for the impeachment shall be presented to the Welfare Committee of the Division provided it is signed by two-thirds of the voters in the Representative's precinct.

No. 2—Upon receipt of such a petition, the Welfare Committee shall notify the Representative of the reason for his impeachment, and he shall be given two weeks to present his side of the case to his constituents, verbally or in writing.

No. 3—At the end of two weeks, a special election shall be held in his precinct, by the Welfare Committee, as herein provided. If two-thirds of the voters are against him, the office shall be declared vacant and the vacancy filled as herein provided.

AMENDMENTS

No. 1—An amendment may be proposed in writing by an Employee at any time.

No. 2—The proposed Amendment shall first go to the Joint Committee of the Division in which it is proposed.

No. 3—If the Amendment is approved by the Joint Committee, it shall be submitted to the Appellate Council, and if approved by the Appellate Council, it shall be submitted to the Joint Committees of the other Divisions. If approved by them, it shall be voted upon by all Representatives of the several Divisions. Upon being approved by three-fourths of the Representatives of all Divisions it shall be adopted.

MEETINGS

No. 1—The newly elected General Committee of each Division shall meet on the fourth Wednesday in April for the election of officers and committees, who are to take office May 1, and thereafter they shall meet on call of the President upon approval of the Secretary of the Joint Committee of the Division. Twenty-four hours shall elapse between issuing the call and holding the meeting.

No. 2—On the first Wednesday in May, and monthly thereafter, the Wage Committee shall meet.

No. 3—On the second Wednesday in May, and monthly thereafter, the Welfare Committee shall meet.

No. 4—On the third Wednesday in May, and monthly thereafter, the Joint Committee shall meet.

Special meetings of the Joint Committee may be called by the Chairman, with the approval of the Secretary.

No. 5—The Appellate Council shall meet on the fourth Wednesday in May, and thereafter, as required and called by the Chairman and Secretary of the Council.

No. 6—Meetings of all Representatives of the several Divisions may be called by the Appellate Council.

PREJUDICE

No. 1—It is understood and agreed that every Representative or Committee man shall be free to discharge his duties in an independent manner and without fear that his individual relations with the Company may be affected in the least degree at any time by any such action taken by him in good faith in his official capacity.

No. 2—To guarantee to each Representative his independence, he shall have the right to appeal directly to the General Superintendent of his Division for relief from any alleged discrimination against him, and if the decision of the General Superintendent is not satisfactory to him, he may appeal to the Joint Committee; and if still unsatisfied, he may appeal to the Appellate Council, and from there to the President of the Corporation, then to the Board of Directors, and then to the Secretary of Labor of the United States.

EFFECTIVE DATE

This plan shall become effective upon the election of the General Committee in each Division.

Factory Management *and* Maintenance

A consolidation of *Factory and Industrial Management* and *Maintenance Engineering*

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▶▶ Sell motion economy right and you have a practical, everyday shop tool. Page 482

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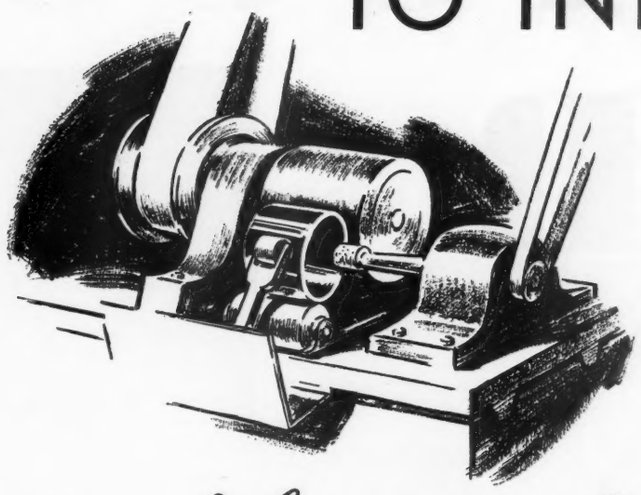

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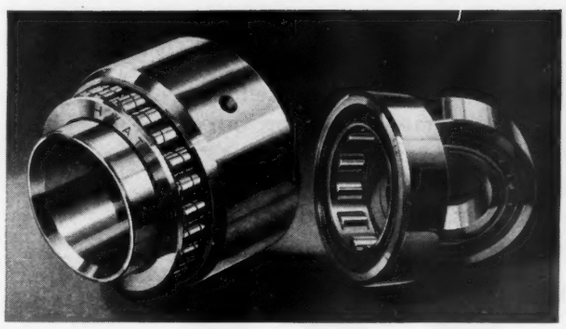
The problem of making races for bearings with wall variations held to an irreducible minimum, that is, with bores and outside diameters truly concentric, has intrigued engineers for years.

Hyatt determined to solve the problem and now with considerable pride and satisfaction we announce the new process which we have originated and nurtured through persistent effort—we call it chuckless grinding.



Soon, all other industries may benefit from this Hyatt research and experimentation which has taken years of effort and which to perfect, cost thousands of dollars in our plant and elsewhere.

But, the furthering of this revolutionary development of grinding accuracy in race manufacture, is only another measure of Hyatt endeavor to find better ways to safeguard quality. We thus hope to insure the continued faith of Hyatt customers. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

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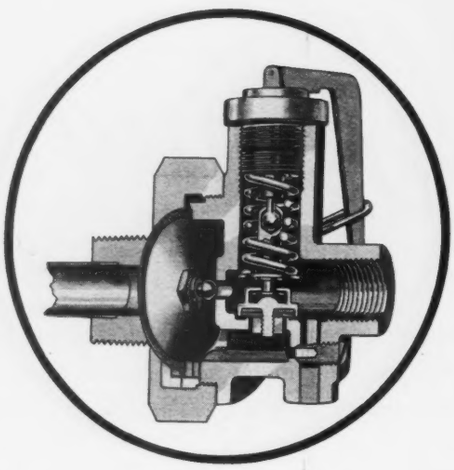

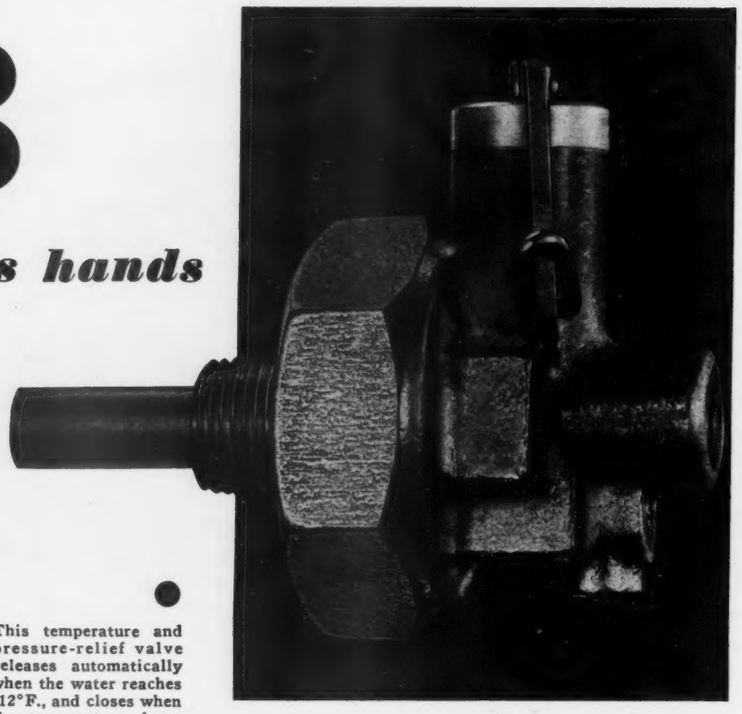

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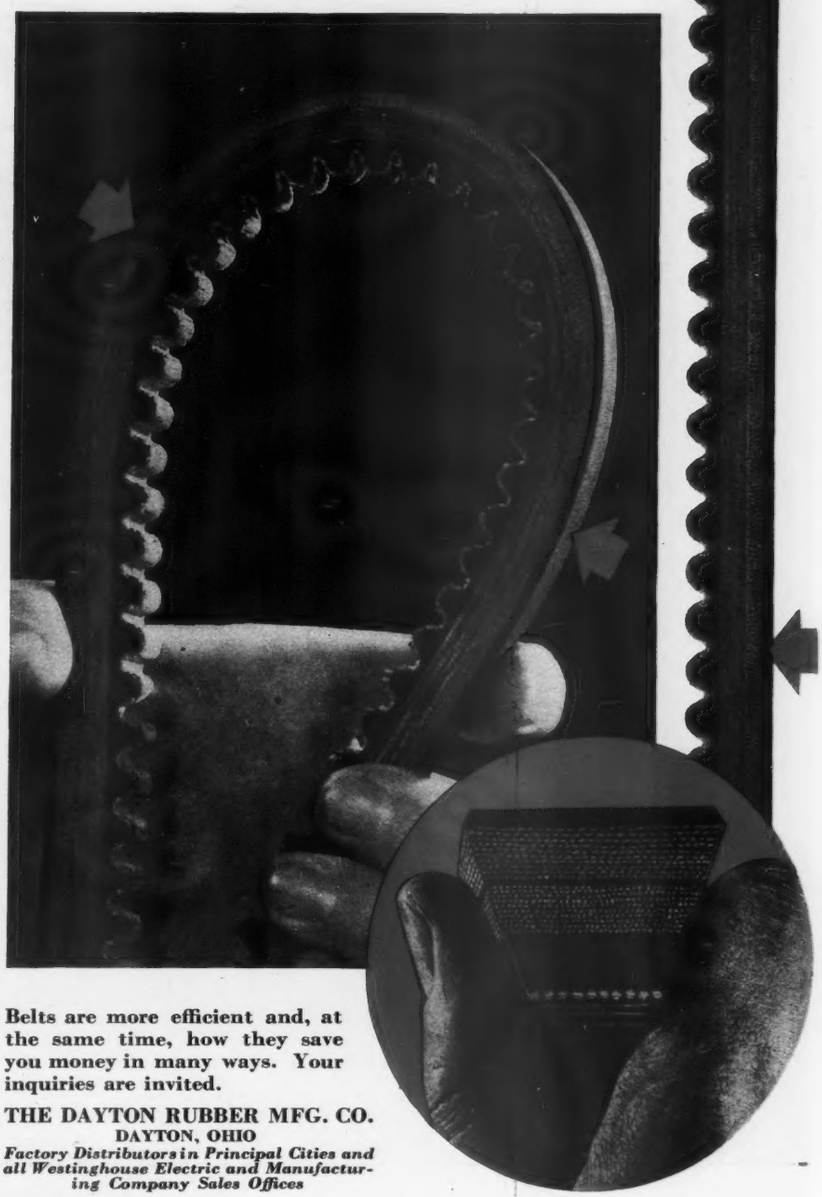


First, mark two points four or five inches apart on the outer surface of a belt. Then bend the belt *double*. And while doubled, measure the distance between the marks again. Note how far the outer section of the belt has stretched. This shows how the outer section of any belt must stretch when going around a pulley.

The Dayton Cog-Belt is the only V-Belt built to take this "stretch" without strain or distortion. The outer section is made of bias-cut fabric—it "gives" without strain; like pulling your handkerchief from diagonally opposite corners.

Also, while the belt is flexed, note how the cogged inner surface has compressed—how the cogs have closed and "taken-up" the compression on the inner surface of the belt.

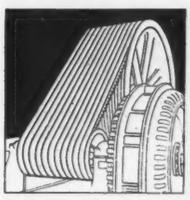
Second, compress a section of a Dayton Cog-Belt between the thumb and forefinger and note the extreme crosswise rigidity. Because of this positive crosswise rigidity there can be no "squashing" in the pulley groove . . . no distortion or twisting.

No other V-Belt combines such extreme flexibility with such positive crosswise rigidity.

And because Dayton Cog-Belts offer these exclusive advantages—because they are *built to bend*—because they have such positive crosswise rigidity—they provide maximum contact arc, have greater gripping power, permit smaller pulleys with closer centers, save floor space, run cooler, require less tension, are easier on bearings, last longer.

But don't stop with making these tests. Let us give you more of the facts—facts that prove how Dayton Cog-Belts are more efficient and, at the same time, how they save you money in many ways. Your inquiries are invited.

THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO
Factory Distributors in Principal Cities and all Westinghouse Electric and Manufacturing Company Sales Offices



Dayton
COG·BELT DRIVES

THE ENEMIES OF MOTOR LIFE CAN'T PENETRATE WESTINGHOUSE INSULATION

Ask this question before you buy Motors

—ARE THE WINDINGS ADEQUATELY PROTECTED, MECHANICALLY AS WELL AS ELECTRICALLY . . .

MOISTURE . . . Oil . . . Grit . . . Mild Chemicals . . . Metallic Dust. These insidious, tireless enemies of motor life can't penetrate the insulation of Westinghouse CS induction motor windings.

Check this point before you buy motors—make sure that the windings are adequately protected, mechanically as well as electrically. By so doing, you make certain that your investment will pay maximum and trouble free returns.

The windings of Westinghouse CS induction motors are dual-protected (mechanically and electrically) against damage and premature old age.

For *mechanical* protection, each individual end-turn is wrapped with tape and the slot portions of the windings are guarded against damage by a combination-slot cell.

For *electrical* protection, accurately controlled impregnation treatments are given, thoroughly saturating every part of the windings—inside the slots as well as the taped end-turns. These treatments provide maximum protection against damage from moisture, oil, grit, mild chemicals and metallic dust.

Compare the methods of insulating windings before you buy motors. Be sure that the protection, which may be adequate today, is of such a nature that the motor can give you the long, trouble-free performance you rightfully expect from your investment.

For additional information, write the nearest Westinghouse office, consult your local Westinghouse Industrial Electrical Contractor, or address Westinghouse Electric & Manufacturing Company, Room 2-N, East Pittsburgh, Penna.

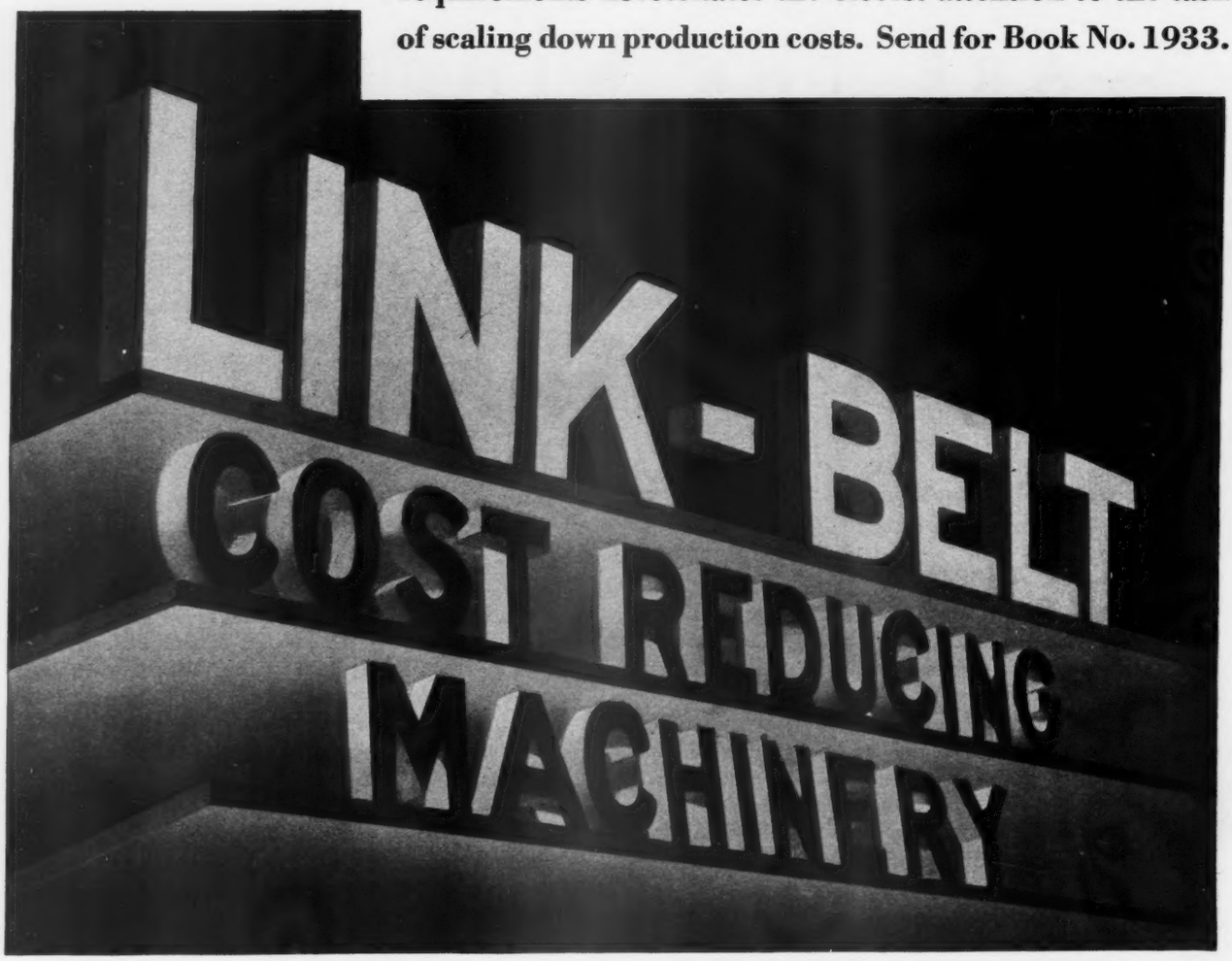
Westinghouse

T 79811

Quality workmanship guarantees every Westinghouse product

many businesses need

to install cost-reducing conveyors, positive drives, and other modern equipment in order to give a good living to employees, produce high grade wares at low cost, and at the same time retain control of profits. Meeting today's requirements necessitates the closest attention to the task of scaling down production costs. Send for Book No. 1933.



LINK-BELT PRODUCTS Include: Elevators and Conveyors for all materials, Coal and Ashes Handling Machinery • Automatic Coal Stokers • Portable Loaders • Electric Car Spotters • Skip Hoists • Car Dumpers • Water Screens • Positive Drives: Silent Chain; Silverlink Roller Chain; Speed Reducers; P. I. V. Gear-Variable Speed Transmission; Chain Drives of all types (Mall. Iron, Promal and Steel) • Shafting, Bearings, Take-ups, Collars, Clutches, Flexible Couplings, Gears, Sprockets, etc. • Cranes Shovels • Draglines • Vibrating Screens.

NRA MEMBER U.S. WE DO OUR PART

LINK-BELT COMPANY

Chicago Plant
300 W. Pershing Road

Philadelphia Plant
2045 W. Hunting Park Ave.

San Francisco Plant
400 Paul Ave.

Indianapolis, Dodge Plant
519 N. Holmes Ave.

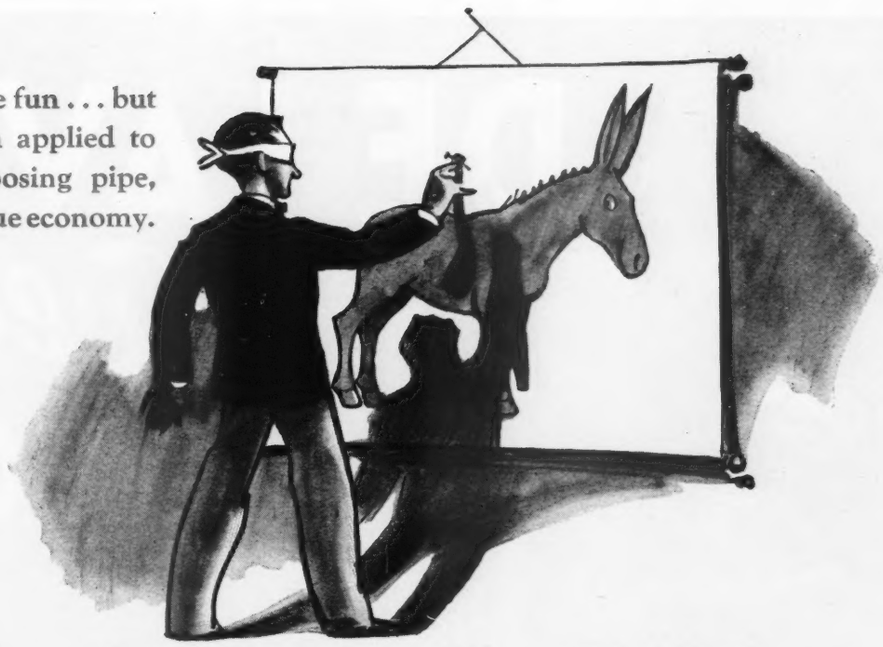
Indianapolis, Ewart Plant
220 S. Belmont Ave.

Chicago, Caldwell-Moore Plant
2410 W. 18th St.

Toronto Works
Eastern Ave. & Leslie St.

4852

blindfold games may be fun . . . but they're *expensive* when applied to pipe selection. In choosing pipe, KNOWLEDGE means true economy.



Here's the Way to Be SURE

You are putting the RIGHT pipe in the RIGHT place . . .

You don't need to be an expert to be *right every time* on pipe selection. Answer two simple questions and you'll KNOW that the pipe you choose will serve long and satisfactorily. Those questions are, "What are the conditions under which the pipe must serve?" and "Which kind of pipe meets the conditions *best?*"

Where corrosion is severe . . . where vibration and strain must be resisted . . . where high temperatures or abrasive action must be overcome . . . Reading Genuine Puddled Wrought Iron Pipe is THE pipe. Under such conditions it saves the *most* money by lasting the longest. And that isn't hearsay . . . it's a fact proved by four generations of actual use in the Nation's buildings and industries.

When Reading Genuine Puddled Wrought Iron Pipe is needed, be sure that you get it!

Here are Some of the Places Where Reading Genuine Puddled Wrought Iron Pipe Serves Best

- *For Cold and Hot Water Lines*

  Reading Puddled Iron Pipe assures *generations* of trouble-free service with all ordinarily corrosive waters. In thousands of such installations, it has been proved that the life of Reading Pipe is from two to five times longer than that of ordinary pipe.

- *For Drains*

  Alternating wet and dry conditions often mean swift death for most kinds of pipe. Reading Puddled Iron Pipe is especially adapted to give long service under such conditions.

- *For Heating Supply Risers, Distributing Mains and Return Lines*

  Due to its high melting point (300 Degrees F. higher than that of steel) and because of the presence of non-metallic silicate, Reading Puddled Iron is far less subject to destructive oxidation than other ferrous metals.

- *For Vents*

  When exposed to atmospheric corrosion, Reading Puddled Iron Pipe forms *two* hard impervious films of oxide which effectively prevent destructive pitting and penetration of rust. Corrosion is actually *stifled.*

READING GENUINE PUDDLED WROUGHT IRON SINCE 1848

READING IRON COMPANY, PHILADELPHIA

SCIENCE & INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON

DE LAVAL *Speed* REDUCERS

THESE solidly built, correctly cut, worm gear units combine high efficiency in power transmission with silence, safety to workmen, compactness, simplicity and reliablity in continuous, full load service.

They are arranged for right or left hand drive, or with either shaft extended both ways, and with the worm at top or bottom. The right angle arrangement often saves aisle space.

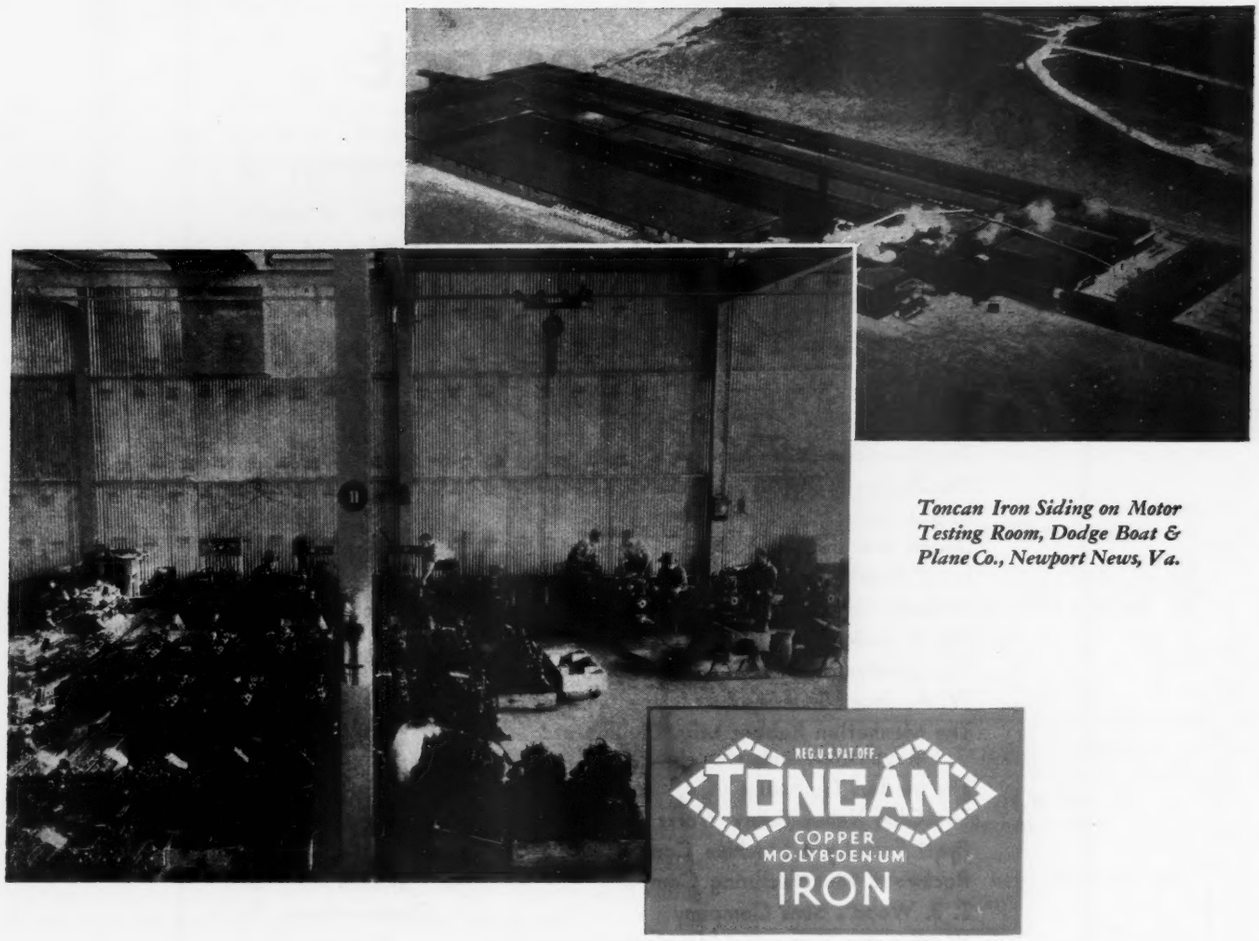
The high speed worm shaft is mounted in anti-friction bearings, while the slow speed worm wheel shaft is supported either by split sleeve bearings, or by anti-friction bearings, as conditions of use may indicate.

The experience of our engineers is at your service to select the best drive for your machine.

DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

TONCAN IRON

COMBATS CORROSION IN INDUSTRIAL BUILDINGS.



Toncan Iron Siding on Motor Testing Room, Dodge Boat & Plane Co., Newport News, Va.

REG. U.S. PAT. OFF.
TONCAN
COPPER
MO·LYB·DEN·UM
IRON

Sheet metal siding and roofing on industrial buildings must often withstand double attack. They must battle Nature's forces on the outside—rain, snow, sun, and wind—while on the inside oftentimes gases from industrial processes take their toll.

That's why it never pays to install anything less durable than Toncan Iron on sheet buildings of a permanent character used for industrial purposes.

Time has proved the merits of Toncan Iron—its longer life, its lower cost per year of service. And all because it is a modern alloy of scientifically refined iron, copper and molybdenum with a resistance to rust among the ferrous metals exceeded only by the stainless irons and steels.

Use it on new buildings. Use it for replacements. But don't expect the economy to show on the records until it has seen more service than you ever thought a sheet metal could give.

Write for a copy of "The Path to Permanence." It contains hundreds of actual service records—every one confirmed.

REPUBLIC STEEL CORPORATION

GENERAL OFFICES YOUNGSTOWN, OHIO

Multiple V-Belt Drive Announcement

ALLIS-CHALMERS Manufacturing Company, of Milwaukee, Wisconsin, announces that licenses under United States Letters Patent No. 1,662,511 relating to power transmitting mechanism, commonly known as Multiple V-Belt Drive, have been granted to the following belt and sheave manufacturers:

The American Pulley Company - - - - - - Philadelphia, Pa.
The Dayton Rubber Manufacturing Company - - - Dayton, O.
R. & J. Dick Co., Inc. - - - - - - - - - - Passaic, N. J.
Dodge Manufacturing Corporation - - - - - Mishawaka, Ind.
L. H. Gilmer Company - - - - - - Tacony, Philadelphia, Pa.
Goldens' Foundry & Machine Company - - - - Columbus, Ga.
The B. F. Goodrich Rubber Company - - - - - - Akron, O.
The Goodyear Tire & Rubber Company, Inc. - - - Akron, O.
W. A. Jones Foundry & Machine Company - - Chicago, Ill.
The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc. - - - - - - Passaic, N. J.
The Medart Company - - - - - - - - St. Louis, Mo.
The Ohio Valley Pulley Works - - - - - - Maysville, Ky.
Pyott Foundry & Machine Company - - - - - Chicago, Ill.
Rockwood Manufacturing Company - - - Indianapolis, Ind.
T. B. Wood's Sons Company - - - - - - Chambersburg, Pa.
Worthington Pump and Machinery Corporation - Harrison, N. J.

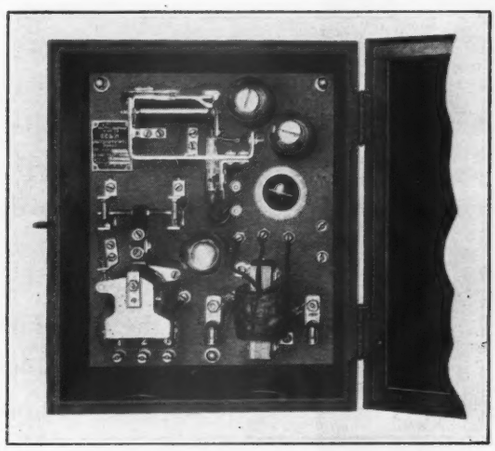
Allis-Chalmers Manufacturing Company

Milwaukee, Wisconsin

accepted

Aeroplane Manufacturers
Aluminum Furniture Manufacturers
Automobile Manufacturers
Automobile Body Builders
Automobile Frame Manufacturers
Automobile Parts Manufacturers
Automobile Wheel Manufacturers
Baker's Supplies Manufacturers
Beer Barrel Manufacturers
Boiler Tube Manufacturers
Can Companies
Chain (Steel Link) Manufacturers
Dairy Supplies Manufacturers
Drum & Barrel Manufacturers
Electric Fuse Manufacturers
Electric Refrigerator Manufacturers
Household Furniture Manufacturers
Office Furniture Manufacturers
Pulley Manufacturers
Radio Manufacturers
Sheet Metal Fabricators
Steel Door Manufacturers
Steel Stamping Companies
Stove Manufacturers
Shipbuilding Companies
Tank (Terne-plate) Manufacturers
Truck Builders
Washing Machine Manufacturers
Wire Manufacturers

by American Industries



The EC&M Automatic Weld Timer for Resistance Welders

because HEAT UNITS are measured automatically —insuring each weld is a perfect weld

A BETTER welded product at a lower cost is a strong claim for the EC&M Automatic Weld Timer, but that is the experience of every resistance welder user of this device to date.

In several plants, where a number of resistance welding machines are used, they have equipped one of these machines with an EC&M Weld Timer and compared its results with the machine next in line which was operated under manual control of the operator. Results were so startling that additional Weld Timers were immediately ordered for the remaining welding machines.

Such performance is outstanding, we'll agree, but we are ready and willing to show you, without any obligation on your part, how one of these EC&M Automatic Weld Timers will not only give you a better welded product at a lower cost, but also in many cases, will enable your operators to turn out more welds per minute. The cost of one of these units is surprisingly low. Write today for complete information.

MAIL THIS COUPON TODAY

THE ELECTRIC CONTROLLER & MFG. CO.
2700 East 79th St., Cleveland, Ohio

Gentlemen:

We are interested in (spot, projection) welding.....pieces of .....

Our welding machine data is.....KVA.....

Volts.....Cycles Capacity in Amps.....

Min.....Max. Operated.....(Manually, air or hydraulically or motor-driven).

We now use.....Amps. current in welding these pieces together and make.....welds per minute.

Name .....

Company .....

Address ..... F.M.M. 12-33

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

NEW YORK-50 CHURCH ST.
CHICAGO-310 So. MICHIGAN AVE.
DETROIT-DIME BANK BLDG.
BIRMINGHAM-BROWN-MARX BLDG.
CINCINNATI-1ST NATIONAL BANK BLDG.
ST. LOUIS-1027 CLAYTONIA TERRACE

LOS ANGELES-912 E. THIRD ST.
HOUSTON-P.O. BOX 4182
TORONTO-92 NEVILLE PARK BLVD.

PHILADELPHIA-WITHERSPOON BLDG.
PITTSBURGH-OLIVER BLDG.
SAN FRANCISCO-CALL BUILDING
MONTREAL-CRESCENT BLDG.
BUFFALO-888 COLVIN BLVD.
SEATTLE-2207-1ST AVE. So.

CUT OPERATING COSTS NOW

Unbalanced

Reflected glare: *Causes errors and inaccurate workmanship.*

Direct glare: *Resulting eye-strain retards production.*

Shadows: *Deep and sharp, instead of flat, "smooth" and subdued.*

Maintenance: *Complicated. Glass-changing should be easier.*

Today's demand for economies can be constructively met with better lighting... Repeated tests have proved that a better lighting installation usually results in a 10% to 25% increase in plant efficiency. Operating and maintenance costs are correspondingly lowered.

The effects of better lighting are felt all along the line. Lower production costs... less spoilage... decreased accidents. Production per man increases. Quality of product improves. Materials handling speeds up. Better inspection results.

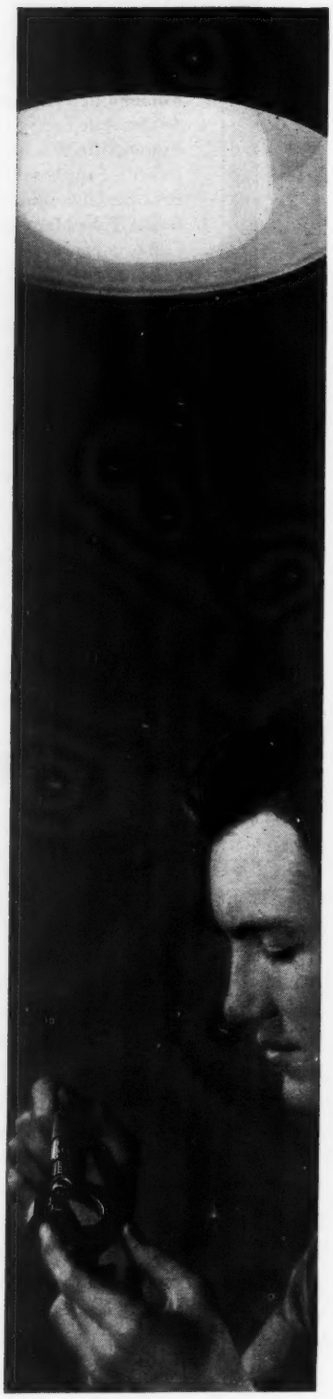
A Complete Service on Industrial Lighting and Accessory Equipment

Graybar's experienced lighting experts can show you the best way to make lighting work for you now. And Graybar's complete service of supply on industrial lighting makes available not only a complete line of quality fixtures, but all accessories — lamps, controls, and wiring materials as well... An interesting booklet on Industrial Lighting gives more details. Ask for it — with the coupon below.

GraybaR

OFFICES IN 73 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BLDG., N. Y.

Balanced Lighting



Vision is at its best when all the many variable lighting factors are "balanced."

SEND FOR THIS BULLETIN

Graybar Electric Co., Graybar Building, Lexington Avenue and 43rd Street, New York, N. Y. FM 12-33

Gentlemen: Please send me your Complete Bulletin on Industrial Lighting.

NAME..... ADDRESS.....

THIS NEW . . AND VERY SPECIAL . . KIND OF LUBRICATION RIGHT HERE . .

. . inside the rope . .

between the wires . .

plus PREFORMED CONSTRUCTION

is giving wire rope users longer wire rope life . . lower wire rope cost

●

The new Macwhyte internal lubrication gives each wire in the rope a heavy, thick, viscous coating. Heat does not melt or flow it. Cold does not cake it. Water and mild acids do not even touch it.

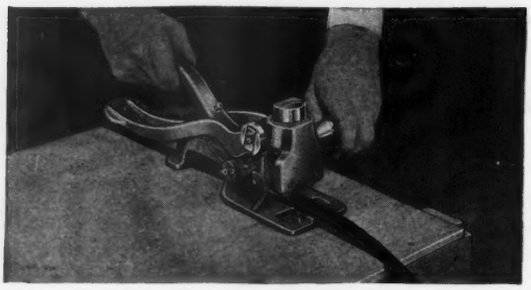
Add to this extraordinary lubrication the advantage of PREFORMING—available in Macwhyte ropes — and you have a combination that is bringing many of the country's most experienced wire rope buyers into the Macwhyte fold of satisfied customers.

MACWHYTE COMPANY, KENOSHA, WISCONSIN

Specify "Monarch Whyte Strand"—PREFORMED for maximum service

MACWHYTE WIRE ROPE INTERNALLY LUBRICATED

Stanley Improved "3 in 1" Strapping Tool



This latest model Stanley Tool combines in one unit the tightening, sealing and cutting operations, thus doing away with the now obsolete three-tool method.

Banding packages for safe transit and delivery has long since proven its tangible worth. We now offer a greatly improved tool that does the job *faster* and *better*, and at a *material saving* in cost.

This New "3 in 1" Tool is sturdily built, easy to operate and a great improvement over the original Stanley "3 in 1", which was the first combination strapping tool ever put on the market.

Your own INDIVIDUAL BRAND of Nailless Strapping, bearing your Company Name, Trademark or Slogan in BRILLIANT COLORS, coupled with this time saving equipment, make possible the very highest efficiency in package reinforcement.

THE STANLEY WORKS

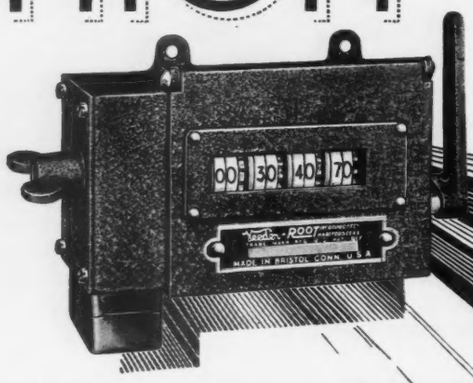
New York 100 Lafayette St.
Box Strapping Division New Britain, Conn.
Chicago 62 W. Kinzie St.

STANLEY EVERSAFE (Round Safety Edges) Japanned Nailless Strapping furnished in all standard widths and gauges.

DUPONT FOR BETTER PICTURES

Illustration of Colorgraph Strapping, which can be finished in any design and almost any color combination.

HIGH SPOTS IN Profit-Planning



HOURLY PRODUCTION TOTALS AT INDIVIDUAL MACHINES

COST PER PIECE UNDER THE N.R.A. WAGE RATES

SAVINGS POSSIBLE BY IMPROVED OPERATOR EFFICIENCY

SAVINGS THROUGH ELIMINATING OVER-RUNS AND UNDER-RUNS

Veeder-ROOT COUNTERS

make profits materialize from *planned operating*, not hopeful speculating

Ask about applications

BUILDERS OF COUNTERS — Veeder-ROOT INCORPORATED HARTFORD, CONN. — FOR EVERY PURPOSE

You want to know...

CHROME POISONING

If you're using any of the chromium compounds, you should get "Protection of Workers Exposed to Chromium and Its Compounds." This little booklet, just issued, describes preventive measures for such troublesome things as chrome dermatitis, ulcers, irritation of the respiratory mucous membrances, etc.

THREE-LIGHT LAMP

Contains two filaments, provides three levels of illumination, thereby affording a flexibility in general lighting never before possible.

NON-SCUFFING KID

Score another for modern scientific research. Glazed kid, otherwise a superior material for shoe uppers, scuffs. Needn't, if tanned by a newly developed process. It impregnates the leather with materials that not only give support to the fibers, but also lubricate them permanently, thereby providing against breakdown from flexing.

TRAINING SCHOOL

Rubber concern has trained 25 general foremen and factory staff workers to assume leadership of groups ranging from 25 to 40 people, including foremen, supervisors, and inspectors. Total enrollment, about 700 employees. Conference method of adult training used throughout.

WATER-RESISTANT PLASTICS

Two years in a molded plastics jar had no ill effects on a water-base complexion cream, according to a test made by one of the phenolic people. Cream and jar were in perfect condition, proving that the material is suitable for applications requiring a non-hydroscopic compound.

FAR PASTURES

An automotive manufacturer has turned brewer, threatens to make 150,000 barrels of ale a year. Proving, possibly, that the grass, etc., and maybe it is.

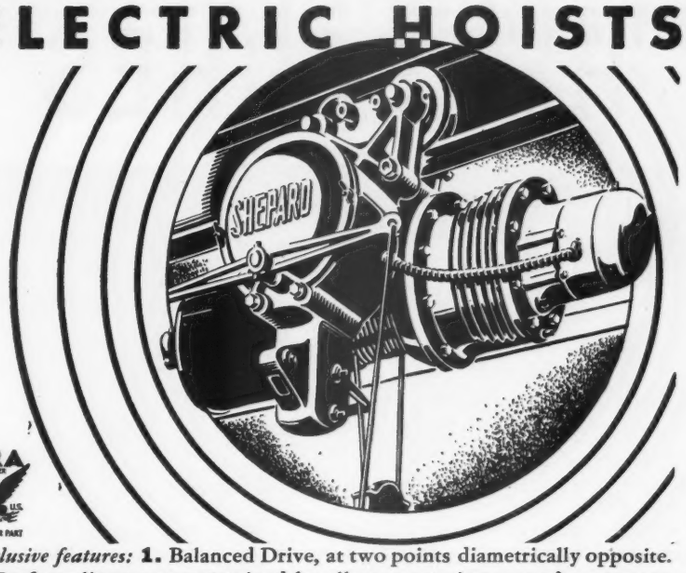
VIBRATUNED LAMP

Withstands vibration, because it keeps in step with the tiny impacts. The manufacturers have departed from the customary rigid filament mounting, adopted a flexible structure. Costs more, gives 12 per cent less average light output than standard lamp, but may last three or four times as long.

CYCLE SPLITTER

Not yet commercially available, but interesting because of many possible industrial uses. It's a high-speed timing device that splits one cycle of a 60-cycle wave into 60, 100, even 1,000 parts. Used in the laboratory to show the fraction of a cycle required for a high-speed relay

SHEPARD
ELECTRIC HOISTS



NRA MEMBER U.S. WE DO OUR PART

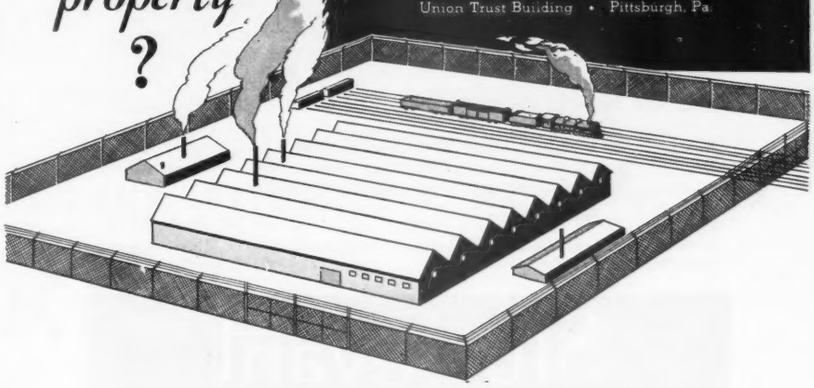
Exclusive features: **1.** Balanced Drive, at two points diametrically opposite. **2.** Perfect alignment, maintained by all parts rotating around a common axis. **3.** Automatic Oil Bath Lubrication. **4.** Control by rope, push button, outrig or controller for every hoist. **5.** Precision variable speed control for both A. C. and D. C. **6.** Variety of speeds, types, lifts and capacities precisely suited to any service. *Write for complete data.*

SHEPARD NILES CRANE AND HOIST CORP.
364 SCHUYLER AVENUE *MONTOUR FALLS, N. Y.*

Keep out squatters and encroaching neighbors by enclosing your property with fence. Fence marks the boundary line permanently and preserves every square foot of your property for your own use. Pittsburgh Chain-Link Fence, because of its exceptional durability and resistance to damage from accidents, is the ideal enclosure. Send us a plan of your property and we will gladly submit specifications and estimates of cost of fencing.

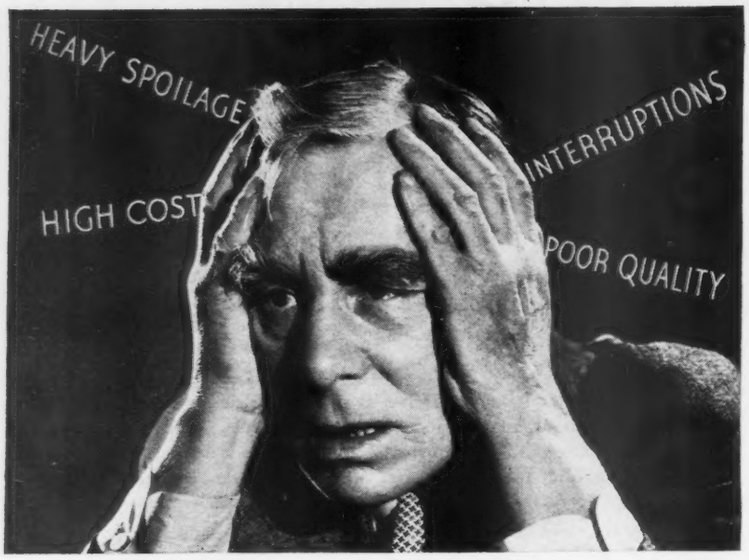
PITTSBURGH STEEL COMPANY
Union Trust Building • Pittsburgh, Pa.

WHO *owns your property* ?



Pittsburgh Fence

CURE THE HEADACHES



of Weather-weak Production

Is your production geared to the weather? Does it falter when the weather isn't "right"?

Why suffer any longer the interruptions, the shut-downs, the spoilage, the costly losses that are caused by untamed indoor climate?

Through the use of Sturtevant cooperation and equipment, companies in a wide variety of industries have permanently solved the "indoor weather problem", have in practically all cases enjoyed worth while economies, and in some instances have saved many thousands of dollars.

It would pay you to investigate the cost-cutting opportunities offered by modern industrial air conditioning. As pioneers in this field, we can give you expert advice and the benefit of many years of practical experience.

● *Sturtevant Cooling and Air Conditioning Corp., a division of B. F. Sturtevant Co., is organized for engineering and installing complete Industrial Air Conditioning Systems.*

B. F. STURTEVANT COMPANY
Main Offices: Hyde Park, Boston, Mass.; Chicago, Ill., 400 N. Michigan Ave.; San Francisco, Cal., 681 Market St. *Branch Offices in Other Cities*

Sturtevant
Made-to-Order Climate

to operate, the method could be used to measure elapsed time of any brief event —reaction time during psychological studies, for example.

DEVELOPING MACHINE

Motor-driven. For making black-and-white positive prints without the use of a negative. Prints up to 36 inches wide. Can be used by anyone owning a blue-printing machine.

PACKAGING EXPOSITION

Fourth annual. Not until March, but worth noting on your Calendar pad right now. Source of information on package design and redesign, as well as reduction of packaging overhead and shipping costs.

CUTS FUEL COSTS

An English railroad reports that the total cost of fuel oil for its new Diesel-electric locomotives is only $4 a day.

LIGHTNING RODS

Seem to be in again. At least a modern lightning rod system has been installed on a 48-story New York office building so that research engineers may observe the pranks of natural lightning when it gets loose in the big city.

WOOD BRIQUETTES

A new briquetting machine makes little logs out of shavings and sawdust from saw and planing mills. Good domestic fuel. Clean, easy to handle, no soot, little smoke, 3/10 of 1 per cent ash.

PACKAGE PIONEER

Last year a belt manufacturer doubled holiday sales by putting his product in a molded plastics cigarette box, will do it again this season.

UNIFORM COSTS

Manufacturers confronted with the need for some plan of uniform cost accounting and reporting—and there are many who are—will find in a recently issued booklet a review of the activities of 75 trade associations and a discussion of questions that normally arise in the development of such a program. Ask us about "Uniform Cost Activities in Trade and Industry."

SPEEDIZED WOOD SCREWS

Easier to drive, 'tis said. Hold better after being driven because smaller lead holes can be used.

WEATHER-PROOF

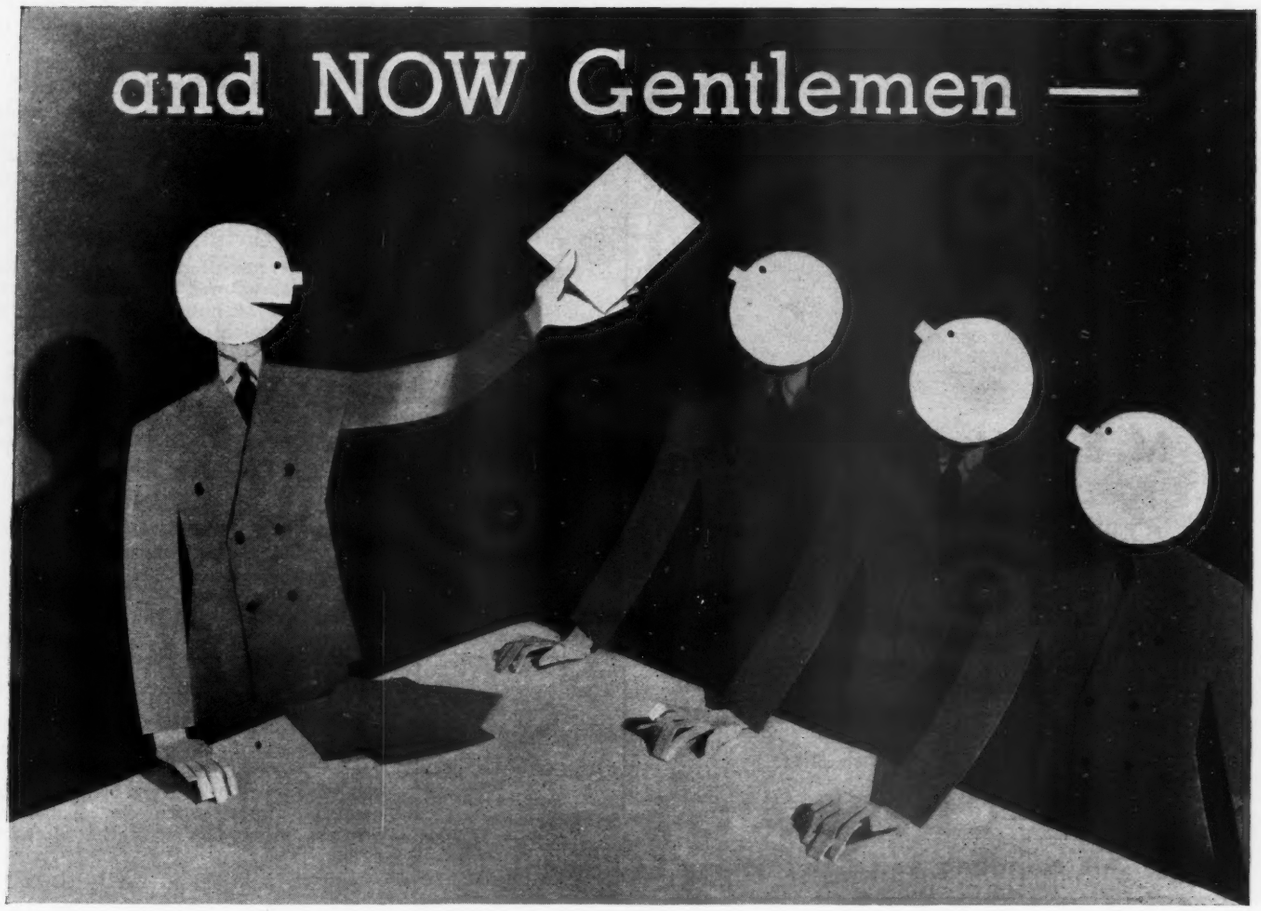
A welded, all-metal roof on a New York State calcining plant presents no crevices under which the wind can secure enough leverage to rip off sheets.

EQUILIBRIUM MOISTURE CONTENT

Of wood in the woodworking shop, dry shed, or any type of lumber storage shed may be measured by a simple indicator just developed.

SOIL-HEATING CABLE

A steel plant had difficulty in winter with its lubricant for roll-neck bearings. It congealed in the pipe lines. Doesn't now. Reason, soil-heating cable. A paint laboratory uses it, too, to control



let's talk about the Weather

Uncontrolled weather can "break" a product . . . for materials and factory equipment are sensitive to atmospheric conditions. Daily or hourly changes of weather cause quality to vary, machines to jam, and cause spoilage and production costs to increase.

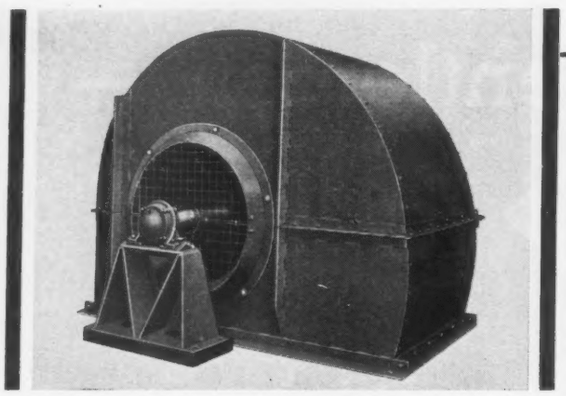
Parks Certified Climate is *controlled* climate. It is the corrective for all production difficulties created by adverse weather. It supplies clean air, at the right temperature and humidity, for a single room or an entire building. It improves products, aids processes and increases human comfort.

Write today for "A Guide For Those Who Must Outwit Climate." It tells how Certified Climate is helping to smooth out production troubles and increase profits for many companies. And also, it contains specially prepared tables of the best atmospheric conditions for manufacturing and storing different products.

PARKS-CRAMER COMPANY, FITCHBURG, MASS., U. S. A.

PARKS *Certified* **CLIMATE**

Stetson Shoes and McCallum Silk Hosiery are made in Parks Certified Climate. We will be glad to tell you whom we are serving in your industry.



MECHANICAL DRAFT

YOUR POWER PLANT—How long has it been since you checked its operating costs? The installation of modern, highly-efficient draft equipment—CLARAGE FANS—may point the way to marked economies in the production of your power. We are equipped to meet mechanical draft requirements of any type, large or small. Your inquiry is invited. CLARAGE FAN COMPANY, Kalamazoo, Mich. Sales Engineering Offices in All Principal Cities.

WE ALSO BUILD:

Air Conditioning Systems
Air Washers
Blast Gates
Combination Unit Heaters & Coolers
Dehumidifying Systems
Exhausters
Heating & Ventilating Systems
Humidifying Systems
Pressure Blowers
Synchrotherm Unit Heaters
Unit Air Conditioners
Unit Coolers
Unit Heaters
Ventilating Fans
Volume Blowers
Vortex Controls
Waste Heat Fans

NRA MEMBER U.S. WE DO OUR PART

CLARAGE

Air Handling and Conditioning Equipment

PYROIL

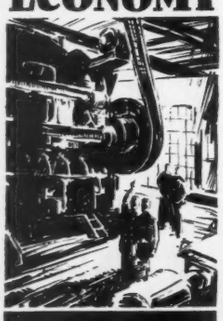
(Simply Add to Regular Oil)

···Effects ECONOMY

In a recent field service bulletin issued to all policyholders the use of Pyroil has been endorsed by the **Grain Dealers National Mutual Fire Insurance Company of Indianapolis**, following ten months' investigation and test of this product.

Pyroil cures hot bearings, reduces fire hazards, reduces wear, safely protects all equipment. Mail coupon for important facts and **Trial Test Offer.** Manufactured, Patented, Guaranteed by Pyroil Company, W. V. Kidder, Pres., 275 LaFollette Ave., LaCrosse, Wisc, U. S. A.

NRA

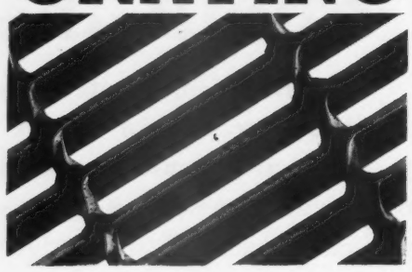


PYROIL REG. U.S. PAT. OFF.

PYROIL COMPANY
275 LaFollette Ave., LaCrosse, Wisc., U.S.A.
Please send important facts and proof of Pyroil's super-efficiency. Also, *Trial Test Offer.*

Name .....
Address .....
City ..... State.....

GRATING



ONE-PIECE

One-piece Electroforged construction gives Blaw-Knox Grating exceptional strength and eliminates all loose parts and rattles.

Send for Blaw-Knox Catalog No. 1333—giving complete details and safe load tables.

BLAW-KNOX COMPANY
2031 Farmer's Bank Building
Pittsburgh, Pa.

BLAW-KNOX

BLAW-KNOX

heat in a water bath which maintains constant humidity for testing paints in a saturated atmosphere.

LOWERED BOX INVENTORY

A Pennsylvania manufacturer using 1,350 different boxes to package gaskets for the automotive trade adopted metal-edged boxes and reduced that number to 93 sizes.

WON'T RUST

Scientific rust-proofing as a base for the enamel assures Michigan drivers that their 1934 number plates will retain their original good looks.

REUSABLE PACKAGE

A New York packer packages pork sausages in an earthenware crock that can be used as a refrigerator container, tobacco jar, bean pot, etc.

PACKAGE-TUMBLER

Spiral flutes and narrow bands, one white, one colored, impart artistic appeal to a glass container for one concern's peanut butter. Children—sometimes grown-ups—like the peanut butter; housewives like to replenish their ever-diminishing stock of everyday tumblers.

FUSE PULLER

A plier-like tool completely encased in molded synthetic resin eliminates all danger in locating blown fuses and testing live wires. A Neon lamp in the handles glows when the gadget is brought in contact with the electrical circuit.

TIME STUDY

Is now being taught by mail, according to announcement of a Connecticut school recently established.

PLASTICS PRIMER

A booklet for the enlightenment of those who think of synthetic resin plastics merely in terms of molding compounds.

LUSTEROID PUFFER

A tube with a nozzle. You fill it with graphite, say, and by alternate squeezing and releasing, "puff" it onto the springs of your car. Works with powdered abrasive, talc, rouge, even volatile solids, in many industrial applications.

On the Calendar

DECEMBER

27-Jan. 2, American Association for the Advancement of Science, winter meeting, Boston, Mass. Dr. Henry B. Ward, Secretary, Smithsonian Institution Building, Washington, D. C.

JANUARY

22-25, Society of Automotive Engineers, annual meeting, Detroit. John A. C. Warner, Secretary and General Manager, 29 West 39th St., New York.

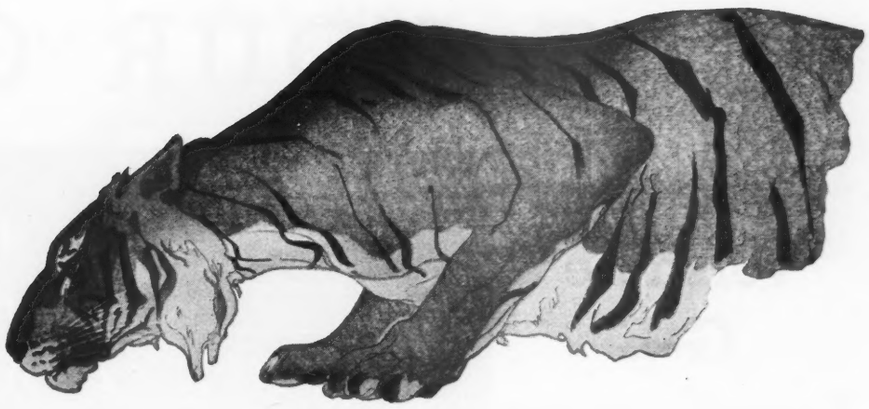
FEBRUARY

5-9, Third International Heating and Ventilating Exposition, Grand Central Palace, New York. Auspices of American Society of Heating and Ventilating Engineers.

5-9, American Society of Heating and Ventilating Engineers, annual meeting, New York. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

MARCH

13-16, Fourth Annual Packaging Exposition, New York. American Management Association, Packaging Exposition Headquarters, Room 1605, No. 232 Madison Ave., New York.



The Invisible ENEMY of Fair Pricing

Your responsibility toward the Consumers' Advisory Board is the simplest condition of the NRA. The code simply asks you to give the consumer his money's worth. And your whole ideal in product pricing is to do just that.

But your pricing must also be in fairness to your workers and your business.

It is here that the invisible enemy of fair pricing works against the consumer and your business—the UNSEEN wastes of the materials which go into your product. The routine wastes have long since been checked by your own alertness. But insidious wastes, elusive to the eye, march on in production and take quickly repetitive toll from each operation.

Inaccuracies in recording material movement must be carried to your accounting department, leading to inaccurate inventory values and presenting to management untrustworthy figures of operations.

Cost figures are only as accurate as weight figures. At scores of points in production, weight control of counts and measurements provides the mathematical accuracy which is reflected in true balance sheet figures. The urgency of this condition in the face of your higher wages, shorter hours and increased material costs is plainly evident.

Realizing this, Toledo Scale Company places at your disposal, in 181 cities, men who will place before you an analysis of the loss points in your production and their cash value. This without expense to you and without disturbing your production.

Quick action on fast recurring losses is vital. We will act quickly—and your phone call to the nearest Toledo Scale office will set us in motion. Or simply fill out and send in the form below, which is provided for your convenience.

READ THIS—IT'S IMPORTANT

Do you know about the sweeping changes that weighing equipment has undergone in the last four years—and how they can benefit you? The photo-electric tube, automatic printers and graphic recorders have revolutionized weighing. The photo-electric tube introduces unlimited power, and for the first time makes it possible for the scale to operate auxiliary machinery without any sacrifice of accuracy in weighing operations. Automatic printers now provide printed weight records, ending all errors caused by misreading the scale or by illegible hand writing. Graphic records give a clear record, on a well marked chart, of weighing operations. These features make scales not only weighing machines, but devices which play an important part in production processing, testing and inspecting. Costs are reduced through savings in time, labor and material.

TOLEDO SCALE COMPANY, Toledo, Ohio

I would like an opportunity of presenting my production problems to your engineers.

Name_____

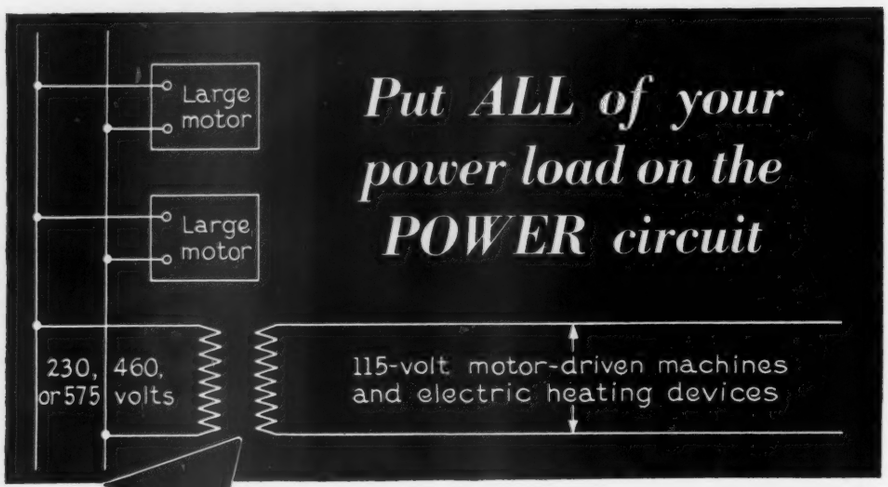
Company_____

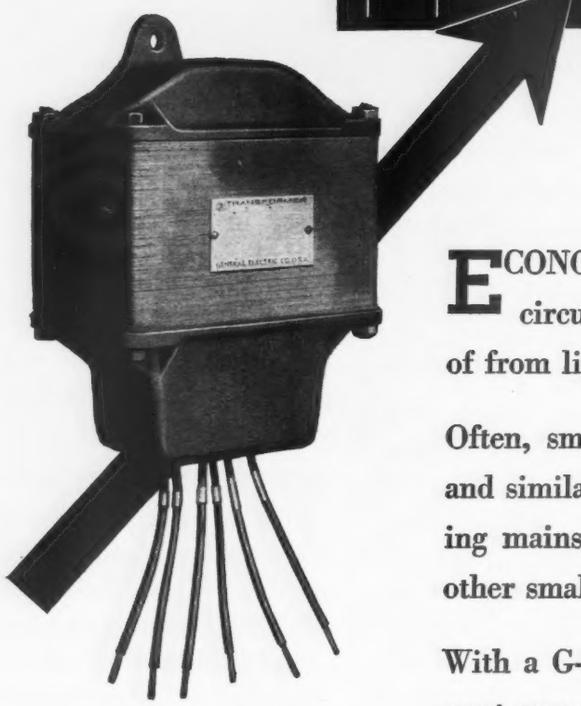
Address_____

_____

CUT YOUR COSTS

with these versatile G-E Transformers


Large motor
Large motor
Put ALL of your power load on the POWER circuit
230, or 575
460, volts
115-volt motor-driven machines and electric heating devices



ECONOMIZE by operating small tools from power circuits — where the power rate is lower — instead of from lighting circuits.

Often, small drills, compressors, grinding wheels, fans, and similar motor-driven devices are connected to lighting mains. Also, many soldering irons, glue pots, and other small users of heavy current are so connected.

With a G-E air-cooled transformer you can obtain the most economical voltage—*where you want it.*

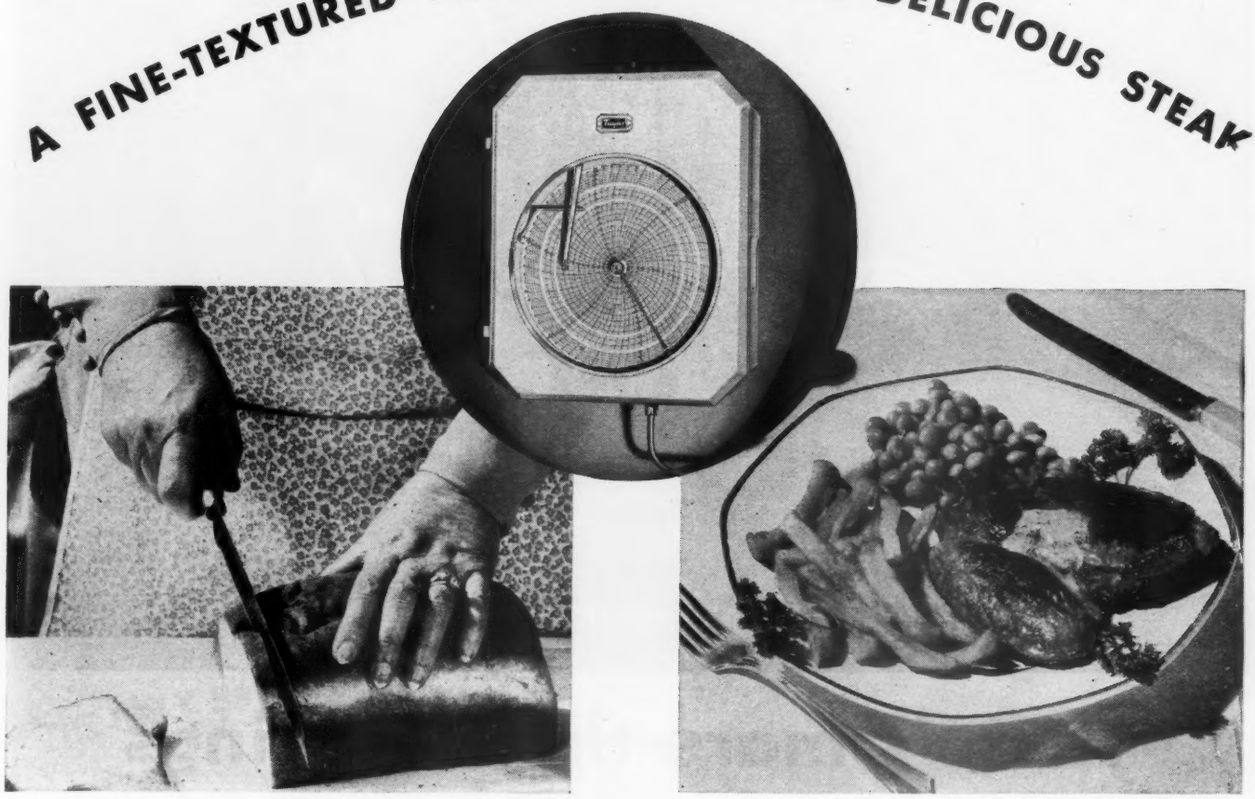
G-E air-cooled transformers are small, light, clean, and easy to install. There is no maintenance, no inspection, no fire hazard.

Information on the design and application of G-E air-cooled transformers is given in Bulletin GEA-897C. The nearest G-E office will supply a copy—or write to General Electric, Dept. 6B-201, Schenectady, N. Y.

405-56

GENERAL ELECTRIC

A FINE-TEXTURED LOAF OR A MORE DELICIOUS STEAK



If you need a temperature instrument, buy it now. But let Taylor Service make sure you have complete control throughout the plant to maintain product uniformity and keep costs from eating profits

YOU MUST have it to bake the highest quality bread ... to prepare the best conditioned meat for the markets. In fact, precise, complete control of temperature is essential to the uniform, economical production of *ANY* product. The kind of control that accurate Taylor Indicating, Recording and Regulating Instruments provide in every industry.

It is not enough to have a few good instruments. Taylor can send you, for example, a couple of recording thermometers. The problem of temperature and pressure control is bigger. Maybe instruments should be used where there are none now. Perhaps worn-out, obsolete instruments should be replaced, or instrument control co-ordinated with manufacturing processes. Where such conditions exist, quality varies—costs are too high for these times—materials are wasted.

We offer a special Taylor Service, designed to find out a plant's needs for Temperature Control and to supply these larger needs.

Special Service for all Plants

This Service is for small plants as well as large. It starts with a thorough survey and analysis of your present plant operation, and your existing method of controlling temperature and pressure. It covers specification of the proper Taylor Instruments and includes recommendations for the most accurate and efficient plant control by Taylor engineers who know every type of instrument application. Finally, this Service provides for supervising with your engineers the installation of the temperature control and its proper coordination with manufacturing processes.

Let us tell you more about Taylor Service and the men who perform it. Remember, it is easy to get the help of a Taylor Representative on any temperature or pressure problem. His call places you under no obligation. Address Taylor Instrument Companies, Rochester, N. Y.

SPECIAL TAYLOR NEWS FLASH

All Taylor Temperature and Pressure Recorders and Recording Regulators are now being shipped with a newly designed die-cast case. The instrument mechanism inside contains distinct improvements designed to give industry the most modern, accurate and durable temperature and pressure control equipment. More detailed information on these new Taylor Instruments later. Meanwhile, if you are using them, enjoy their fine accuracy and positive operation.

NRA MEMBER U.S. WE DO OUR PART

† Tycos **Taylor**

Indicating | Recording • Controlling

TEMPERATURE *and* PRESSURE INSTRUMENTS

† The name Taylor now identifies our complete line of products including Tycos instruments.

There's more than bearings to bearing performance

MANUFACTURERS are depending more and more on New Departure's engineering experience and ingenuity for economical manufacture and assured performance. » » » New Departure has never been satisfied just to make a bearing — and let it go at that. » » » New Departure's product is ideas as well as bearings — and its ideas have pioneered new bearing practice since the industry began. » » » And New Departure will continue to research and originate for the benefit of the industry. The results are always available upon request. The New Departure Mfg. Co., Bristol, Connecticut; Detroit, Chicago, San Francisco and London, England.

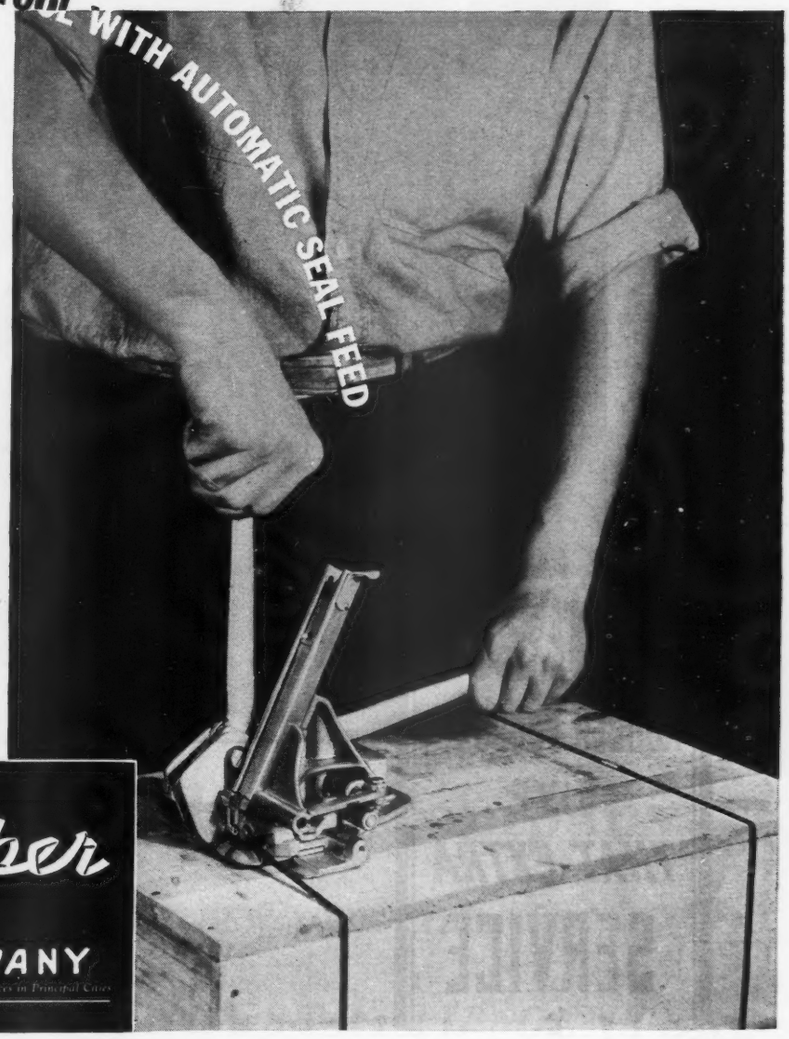
I'm telling you

YOU HAVE NEVER SEEN A BOX STRAPPING TOOL WITH THE EFFICIENCY OF

the new

Acme Steelstrapper

THE ONLY BOX STRAPPING TOOL WITH AUTOMATIC SEAL FEED



One, two . . that's how the handy new Acme Steelstrapper works.

One, two . . and your shipping boxes and cartons are reinforced more efficiently than ever before.

Steelstrapper is the "handiest" box strapping tool ever developed . . a one-unit tool that makes strapping "easy as pie".

It's the only tool with Automatic Seal Feed. A magazine holds a clip of 100 seals—applies them automatically.

Tensioning is done with one stroke of the left hand . . sealing with one stroke of the right hand. No stops to apply a seal. No stops to sever the band—it's all done automatically.

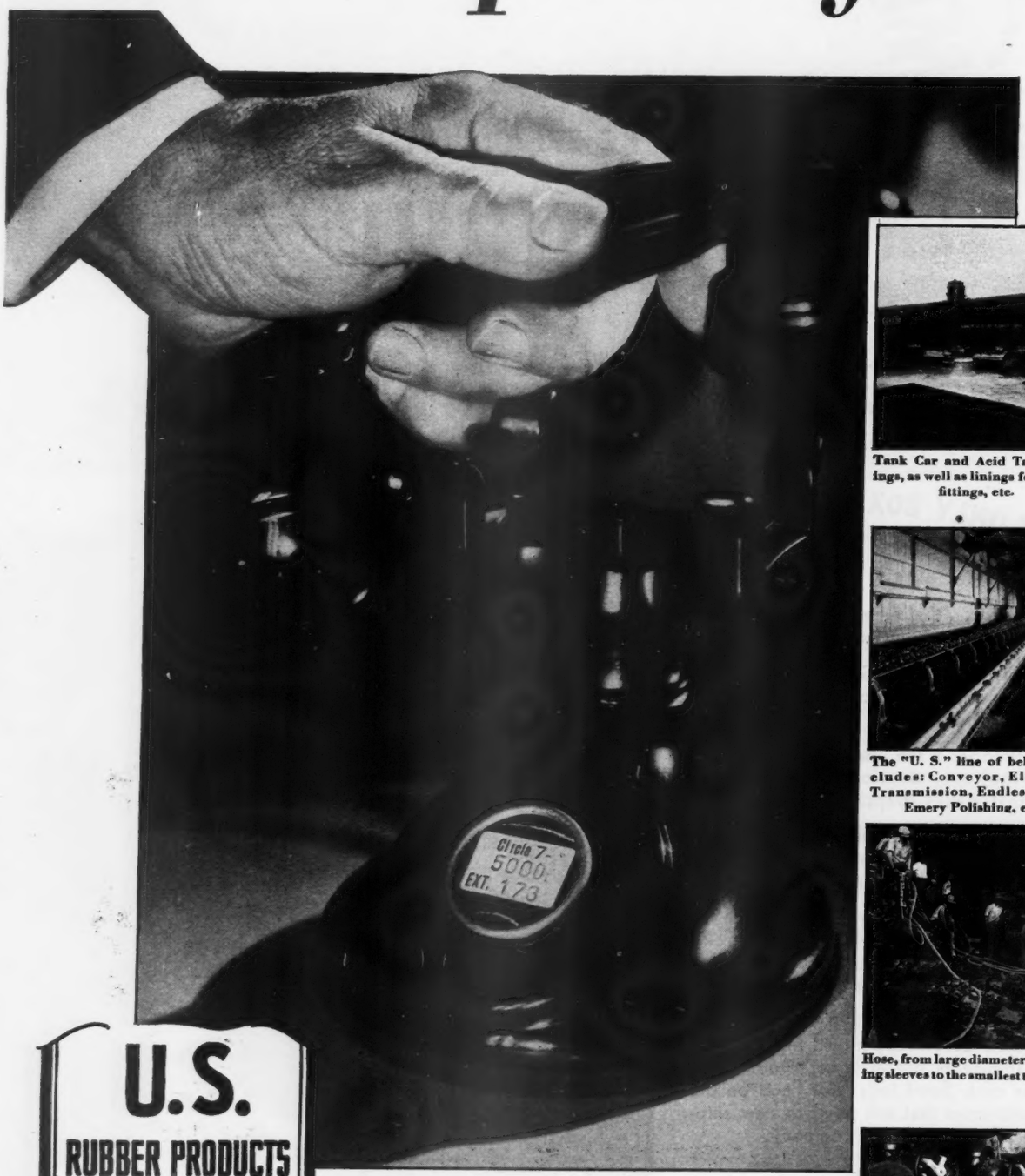
The new Steelstrapper will help you to get shipments out in faster order . . at lower cost. Send today for Facts on the Steelstrapper that will point to new shipping efficiency in *your* company.

Steelstrapper

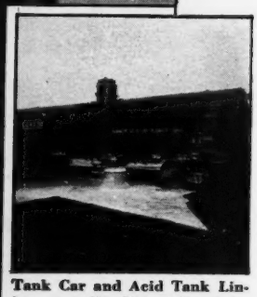
ACME STEEL COMPANY

General Offices: 2837 Archer Avenue, Chicago SAVE STEEL Branches and Sales Offices in Principal Cities

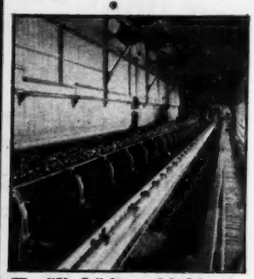
The Simplest of all



U.S.
RUBBER PRODUCTS
GIVE
THAT EXTRA
SERVICE

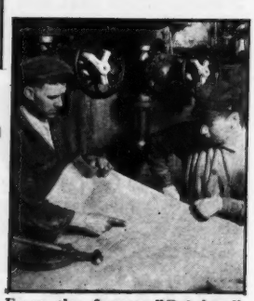


Tank Car and Acid Tank Linings, as well as linings for pipes, fittings, etc.



The "U. S." line of belting includes: Conveyor, Elevator, Transmission, Endless, Acid, Emery Polishing, etc..

Hose, from large diameter dredging sleeves to the smallest tubing.



From the famous "Rainbow" Sheet Packing to high and low pressure Rod and Valve Stem Packings.

NRA WE DO OUR PART

SPECIFICATIONS

Specify duck-weight, adhesion, tensile, elongation, gravity, burst—and you merely establish standards below which a product must not fall.

But those *extra* values above test or specification requirements, that are the fruit of long experience, supreme skill and a complete knowledge of service conditions and demands, are beyond the scope of the most rigid specifications.

Your only assurance of getting these plus values is in the selection of a manufacturer.

In the purchase of industrial rubber products your simplest—and safest—specification is . . . "Call U. S."

—United States Rubber Company—

1790 BROADWAY NEW YORK CITY

BRANCHES IN ALL INDUSTRIAL CENTERS

A NEW AND SIMPLER TILTING FORK TRUCK

NRA MEMBER U.S. WE DO OUR PART

MERCURY TILTING TELESCOPIC TIERING TRUCK *has* Hydraulic lift and tilt... Magnetic contactor control... Double reduction bevel and spur gear drive axle... Brakes in the drive wheels... Semi-elliptic spring suspension... Ball bearings throughout... Automatic and positive overload protection... Wide gauge wheels for stability... Lighter truck weight for given capacities.

And... Fast, accurate, easy handling... Short turning radius... Greatest safety... Utmost simplicity of construction... All working parts readily accessible... Economy of battery power—gravity lowers the load... Minimum maintenance... 83" clearance height... fork lift 109" maximum for high tiering.

Type "T. T. T." Model A — (S) 1002-1. Lifts 12 ft. 1 in., Clearance 83 in.

Capacities 2500 lbs. to 4000 lbs., available in non-lift, high lift and telescopic high lift, tilting and non-tilting models; with hydraulic tin-plate clamp, ram, chisel, or any variation of forks for pallet handling; either battery or gas powered. Write for illustrated specification sheet giving full details.

MERCURY MANUFACTURING COMPANY
4110 S. Halsted St., Chicago, Ill.

MERCURY

TRACTORS • TRAILERS • LIFT TRUCKS

Originators of

The "TRACKLESS TRAIN"
Method of Material Handling

(*Continued from editorial page 481*)

the times. It is better that the works council or company union be undertaken in a spirit of sincere experimentation and cooperation, not as a sedative or sop to restless labor. Out of some of the plans already in use or now being inaugurated may come an answer, satisfactory at least in a particular industry, for the changing needs and requirements of sound labor relations.

So much for the need of a sound philosophy and a forward-looking and sincere approach if any changes are to be made in the methods of dealing with labor. The actual thoughts and reactions of employees are very different from what some isolated and self-satisfied, if sincere, employers believe them to be. Indeed, these thoughts are very much what the employer himself would be thinking in similar circumstances. The men may or may not protest a sham plan, but rest assured they see through it.

The spirit of the plan counts for a great deal more than its form, and there are available ample and adequate accounts of successful plans[3]. A brief summary of principal points may be in order, however.

Prevailing plans are mostly of two types. Earlier experiments in imitation of the organization of the Federal government, while still in use, have generally given way to simpler plans. One type of plan, with many variations, is the company union, or employees' committee or council. In this plan, employees select representatives who meet in a council usually without the presence of management representatives, to discuss grievances of, or suggestions from, the workers they represent. A majority vote of this council is assumed to determine the position or desires of the working force on any particular question and is so conveyed as a recommendation to the management.

In this plan, only employees are usually eligible to serve on the council or committee, thus automatically excluding the professional union representative. In some plans, however, the employees are permitted, if they desire, to pay the expenses of a fellow employee who represents them. Membership in trade unions is not usually a bar to participation.

The other prevailing type of plan provides for joint representation of management and employees in one council. The number from each side may be equal, or equality of voting strength may be provided independently of numbers. Usually the chairman is appointed by management but may be without vote. Meetings may be held monthly, or at other, preferably stated, intervals. The tendency has been to delegate most of the actual adjustment of issues coming before the council to committees such as committees on working conditions, wages, disputes, as well as on the more constructive phases of factory work such as safety or waste elimination.

With either type of plan, the usual procedure on the part of the employee is for him to take up a grievance or a request with the local representative of his craft, section of the shop, or other voting division. The representative then takes the matter up with the man's superior and endeavors to secure an adjustment. It is the usual ex-

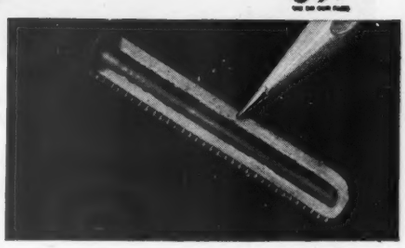
[3]The National Industrial Conference Board has published in all 9 useful reports on the subject. The publications of the American Management Association and the Taylor Society, the Labor Review of the U. S. Bureau of Labor Statistics and the intermittent publications of various personnel groups are helpful. A useful bibliography is published in Tead and Metcalf's "Labor Relations Under the Recovery Act," McGraw-Hill Book Company.

THE EXIDE-IRONCLAD BATTERY ALONE HAS THIS BIG MONEY-SAVING CONSTRUCTION

THE illustration above shows a positive plate of an Exide-Ironclad cell. Note the unusual construction.

The plate is formed by assembling slotted hard rubber tubes over metal rods, held together by metal members at the top and bottom of the plate. The slotted tubes contain the active material. In use, the action of this plate is similar to that of the old-fashioned "tea ball." The electrolyte has free access to the active material through the slots in the tubes, but the active material is prevented from washing away. Thus the positive plate is largely responsible for the extra-long life and consequent low operating and maintenance cost of the Exide-Ironclad Battery.

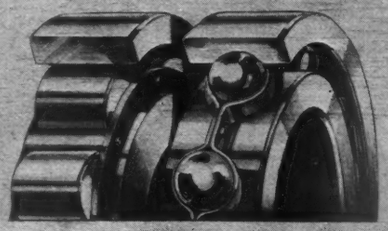
Plants all over the world have found Exide-Ironclads are great money-savers in industrial truck and switching locomotive service. We will be glad to furnish further details.



Here is one of the Exide-Ironclad tubes cut away to show construction

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide
IRONCLAD BATTERIES

TWIN

PRECISION
"NORMA-HOFFMANN"
BALL & ROLLER BEARINGS
for any
LOAD-SPEED *or* DUTY
ASK FOR CATALOG AND ENGINEERING COUNSEL
NORMA-HOFFMANN BEARINGS CORPN.—STAMFORD CONN. U.S.A.

Power Factor Savings

A large textile manufacturer* in Philadelphia recently installed 105 KVA. of Cornell-Dubilier capacitors, Type 846 assembly, 220-volt, at various locations in his plant. And here's the result:

1. A 75% return on investment every year, effected by power bill savings. No maintenance cost.
2. Convenient and economical installation at proper locations in the plant.
3. Overloaded transformers relieved so that larger ratings need not be installed.
4. Line losses in plant circuits considerably reduced, permitting the handling of greater loads.

Most likely you can do the same. At any rate, why not investigate your power conditions? And today, without delay, why not write for our illuminating bulletin, "Save Power Costs!" mailed on request.

*Name furnished on request.

CORNELL-DUBILIER CORPORATION
4377 Bronx Blvd., New York City

perience that as the shop learns how to use a representation plan, the great majority of questions are settled in this stage. Failing such adjustment, the matter may be carried up successively to the superintendent, the secretary or chairman of the council, the council as a whole, or to the president of the company, and, failing settlement there, in some cases to arbitration.

In starting a plan, the first step is usually an announcement, putting the acceptance of the idea up to the men. Announcement may be at a mass meeting, or by distribution of a printed circular, or in various other ways. It is of course advisable to have sounded out the leaders of opinion in the shop before publicly announcing a plan. W. P. Chrysler's statement (November, pp. 454, 455) announcing the joint council plan for Chrysler plants is an excellent example of the right method of presentation.

When acceptance of the plan in principle has been secured, the next step may be the nomination and election of employee representatives. At the first meeting of these representatives, the general purpose and plan of organization will be presented in more detail, and committees will be appointed to develop the bylaws and perfect the details of organization.

These bylaws will ordinarily cover such questions as jurisdiction, or matters with which the council is competent to deal; method of nominating and electing representatives and, in detail, the maner and basis of apportioning representation; the number in each voting unit; the voting divisions, whether geographical or trade, and the manner of representing small scattered groups of employees. Qualifications of voters (usually very simple) and of representatives must be defined. Time of meeting (usually on company time), compensation of representatives, and protection of representatives against reprisals by the company or its officials should be covered. The procedure in case of disagreement between council and company representatives, including the manner of arbitration, if that is included, should be outlined. Finally the manner of amendment, or of terminating the plan, should be indicated.

In general, experience with such plans indicates that employees, who may have radical and impractical ideas at first, sober down rather quickly to a constructive attitude as the facts are put before them. Much more may be trusted to the discretion of a council than the average manager, inexperienced in the field of collective representation, would believe possible. The same experience has often been had, indeed, in dealing with outside unions when the attitude on the part of management has changed from unyielding antagonism to a frank discussion of common and conflicting interests, and to an effort mutually to work out the best adjustment and plan for the prosperity of all.

The case for the works council, the employees' union, or some similar plan of representation is more or less decisive in the large company, where arrogance or misunderstanding of duties on the part of subordinate supervisors may not otherwise come to the attention of management until the danger point has been passed. In the small organization the employee comes into much more direct contact with the personality and philosophy of the management, whether this be good or bad, and a formal council plan is much less necessary to supplement sound personal relations, and has less utility where these relations are not already good.

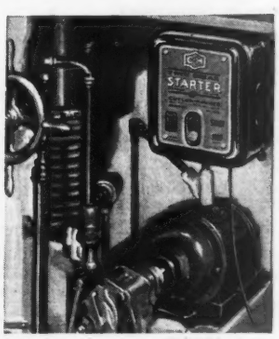
WHY PAY THE PRICE OF INDIFFERENCE?

"THE BIG BOSS SHOULD HAVE MY JOB FOR *JUST A MONTH!*"

THE penalty for indifference toward Motor Control often escapes notice of the men who pay it. It usually is a part of the cost of motor or machine maintenance. It can act as a burden on the speed of production, the dependability of operation, the quality of workmanship, the cost of power or safety of men and equipment.

Motor Control is the one link between human intelligence and motorized machines. It is far more important than either its size or cost might suggest. It is a class of plant equipment which merits most careful selection. Purchase orders should always specify Motor Control by name.

Be sure your plant does not pay the price of indifference. Specify Cutler-Hammer Motor Control for every motor or motorized machine. Motor builders recommend it. Leading machinery builders feature it. Electrical wholesalers stock C-H Motor Control and Safety Switches for your convenience. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1206 St. Paul Ave., Milwaukee, Wis.



MAKE YOUR NEXT BREAKDOWN A TEST CASE

Don't take anyone's word for the importance of Motor Control. Prove it yourself. Select a machine that chronically upsets production. Ask a C-H engineer to recommend correct Motor Control. Let results . . . fewer breakdowns, speedier operation, lower maintenance show you the importance of Motor Control throughout your plant. Call in Cutler-Hammer and uncover savings for years to come.

CUTLER HAMMER

The Control Equipment Good Electric Motors Deserve

NRA

CA-800

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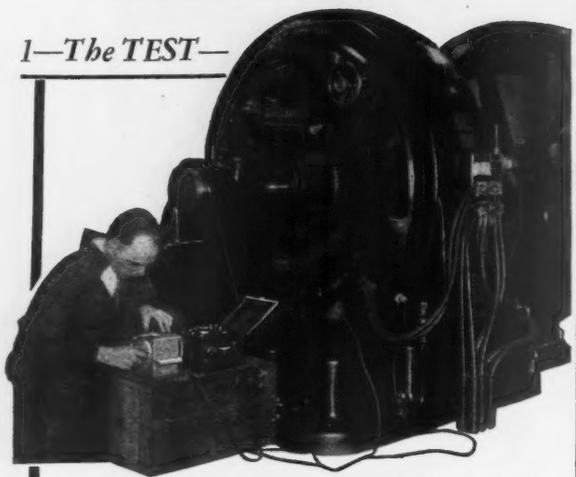
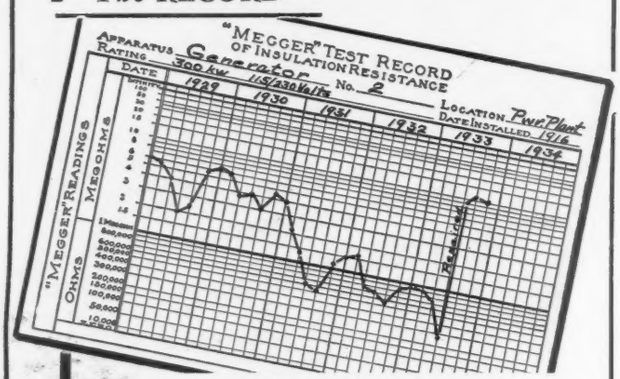
TRADE MARK REGISTERED U.S. PAT. OFF.
INSURANCE

1—The TEST—



Making a "Megger" Test on a D.C. Generator. (Any electrician or engineer can do it.)

2—The RECORD—



3—TYPICAL RESULTS—

"I believe it safe to say that we have saved from $3000 to $5000 by the use of 'Megger' . . . We have two 'Megger' Instruments in our organization and certainly would not be without them."

A Coal Company in Pennsylvania.

"Make periodic tests on all motors and cables . . . Bad leaks in underground cable have been detected and corrected before serious shut-downs have occurred."

A Machinery Manufacturer in Massachusetts.

"On certain groups of motors the insulation values quickly drop to zero when shut down—By using Meggers we keep constantly aware of their condition and place heat on the motors to keep insulation values up—In this way we prevent many delays and much repair work. We have one Megger and two Meg testers. They are in daily use. We find them much more satisfactory for 'trouble shooting' than Magnetos."

A Chemical Plant in Virginia.

"MEGGER INSURANCE" is simply the practice of forestalling electrical failure in the manner illustrated above. *Your* purchase and use of a "Megger" instrument will help you too to prevent shut-downs, improve efficiency and reduce repair and maintenance costs.

Write for Bulletins 1345-F and 1355-F.

JAMES G. BIDDLE CO.
ELECTRICAL INSTRUMENTS
1211-13 ARCH STREET PHILADELPHIA, PA.

(*Continued from editorial page 515*)

If the meter is direct reading, meaning that the dial train is arranged to take care of the ratios of current and voltage transformers, the capacity is calculated directly to indicate at once the actual load on the circuit.

With a balanced load the power factor may be found by disconnecting in turn the potential coil of each element and counting the revolutions of each separately. Then use the formula:

Power factor, in per cent $= 50 \sqrt{(1+a)^3 \div (1+a^3)}$, in which a is the ratio of the speeds of the two meter elements, determined by dividing the speed of the slower element by that of the other. If the slower element reverses its rotation the ratio becomes negative, indicating a power factor of less than 50 per cent.

C. O. VON DANNENBERG, *Brooklyn, N. Y.*

TO DETERMINE the connected power load at a certain period of time, using a stop watch or ordinary watch, count the number of revolutions the disk of the meter makes within a given number of minutes, and reduce this to revolutions per minute.

It is then necessary to find the constant of the meter, which is painted on the disk or marked on the nameplate.

The magnitude of the load is found by the formula:

Watts = Watt-hour constant $\times$ 60 $\times$ r.p.m. of disk.

In order to determine the load on an individual machine it is necessary to disconnect all other loads. When this is done proceed as before. To obtain the horsepower divide the result by 746.

As an example, suppose a certain meter constant is 24 watt-hours per revolution and the disks were found to make 100 revolutions in 10 minutes. Then, R.p.m $= 100 \div 10 = 10$, Watts $= 24 \times 60 \times 10 = 14{,}400$, Hp. $= 14{,}400 \div 746 = 19.3$.

It is to be understood that this test gives the power only during the interval over which the time was taken, but tests can be made at different intervals during the day to determine the average load.

C. R. HASTY, *Assistant Plant Engineer*
Chevrolet Motor Co. of St. Louis
St. Louis, Mo.

Should Production Direct Maintenance?

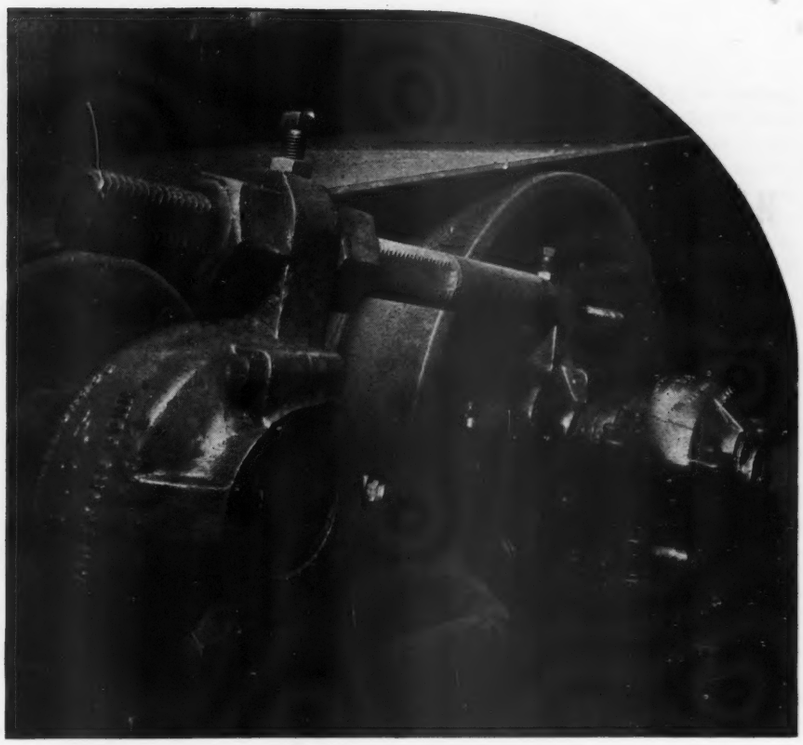
Our production department claims that if it were given authority to tell the maintenance department "what to do" output could be increased and costs lowered. We would like to secure these results, but are not sure that this is the way to do it. At present neither department has any executive authority over the other. I should like to know what the experience of other plants has been in the matter of giving the production department authority over maintenance. *P.J.Q.—Chicago, Ill.*

PRODUCTION and maintenance are two separate functions. One deals solely with manufacturing processes, the other with upkeep of equipment and plant.

Why the production department should have supervision of maintenance any more than it should have charge of equipment engineering, inspection, or any other major department, is more than I can see, unless the head of the production division is also general manager or superintendent of the plant.

In most plants the maintenance department is under

SKF TRANSMISSION APPLIANCES



SKF BEARINGS TO MODERNIZE PLUS

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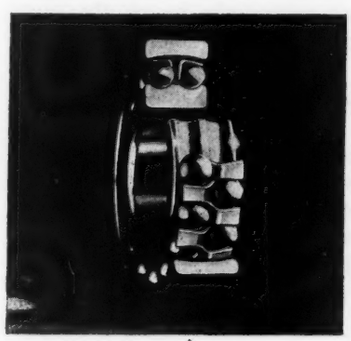
FOR PERFORMANCE... the kind that won't let you down even though the job calls for twenty-four-hour-a-day demand... specify or install SKF Bearings and Pillow Blocks. There's no doubt but what you will get it too, for this installation shown... a conveyor in a large power plant... is expected to and does give unfailing, trouble-free service always... and SKF's properly housed in SKF Pillow Blocks were selected for this all-important work.

Years have now rolled by... and SKF's are still going... doing a full day's work every twenty-four hours with very little attention. SKF Bearings are smooth running, cut power requirements, show no wear and need no adjustments. In SKF Pillow Blocks they have the utmost protection from dirt and harmful matter. Lubricant is kept in for long periods, replenishing is infrequent.

It is not necessary to wait for the installation of new equipment before securing the benefits of SKF Bearings and Pillow Blocks. Specify them on new equipment, of course, but in the meantime get rid of your bearing and housing troubles by changing old equipment and machines to SKF. There's an SKF Bearing and Pillow Block for every job... fans, blowers, shafting, machines and almost any equipment where an outboard bearing can be used. They fit shaft sizes from ⅝ to 14¾ inches... and in two years or less the job pays for itself.

●You may buy a bearing as a bargain but try and get a bargain out of using it, for nothing is apt to cost so much as a bearing that cost so little



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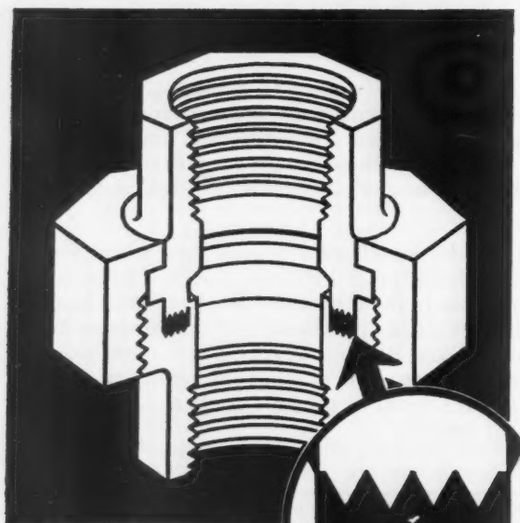


WITH·· THE FOUR-LOCK SEAL

the supervision of an engineer with electrical or mechanical training. I believe this is as it should be, since maintenance deals primarily with the plant equipment. Certainly the maintenance department is better equipped by training and experience to carry on the work more efficiently than is the production department, which has troubles enough of its own.

WM. C. BETZ, *Master Mechanic*
The Fafnir Bearing Company
New Britain, Conn.

Handling Motors Mounted Overhead

Occasionally it is necessary to change lineshaft motors mounted overhead, either to meet changes in production volume or because of trouble. We find that this is a rather troublesome job, possibly because we may not be handling it in the best way. Our motors range from 5- to 50-hp. rating, and are mounted at heights varying from 10 to 15 ft. I wish that other readers would describe the best methods they have found for taking down and putting up motors of the sizes indicated. B.H.H.—Atlanta, Ga.

WE HAVE found that a portable elevator provides a quick, safe, and convenient way of putting up and taking down motors mounted overhead. Fortunately our ceiling heights are reasonably uniform and within reach of the machines used for piling baled paper. However, if we had much motor mounting work to do and had to contend with variable ceiling heights we would make a set of extension guides for use on the higher lifts. In a couple of cases we have changed the lifting height of these machines without any trouble.

H. D. FISHER, *Plant Engineer*
New Haven Pulp & Board Company
New Haven, Conn.

Laying Out Short-Center Drive

We will install an air compressor driven by a 200-hp., 580-r.p.m. motor through a short-center drive with idler pulley. The motor pulley is 28 in. in diammeter, compressor pulley 84 in., and idler 19 in. All have 20-in. faces. I should like to know (1) What should be the distance between centers of the compressor and motor pulleys? (2) Is it necessary to have the centers of the motor and compressor pulleys on the same level? (3) Should the normal level of the idler pulley be above or below the level of the motor pulley? (4) What should be the center distance between the idler and motor pulleys?
R.C.—High Shoals, N. C.

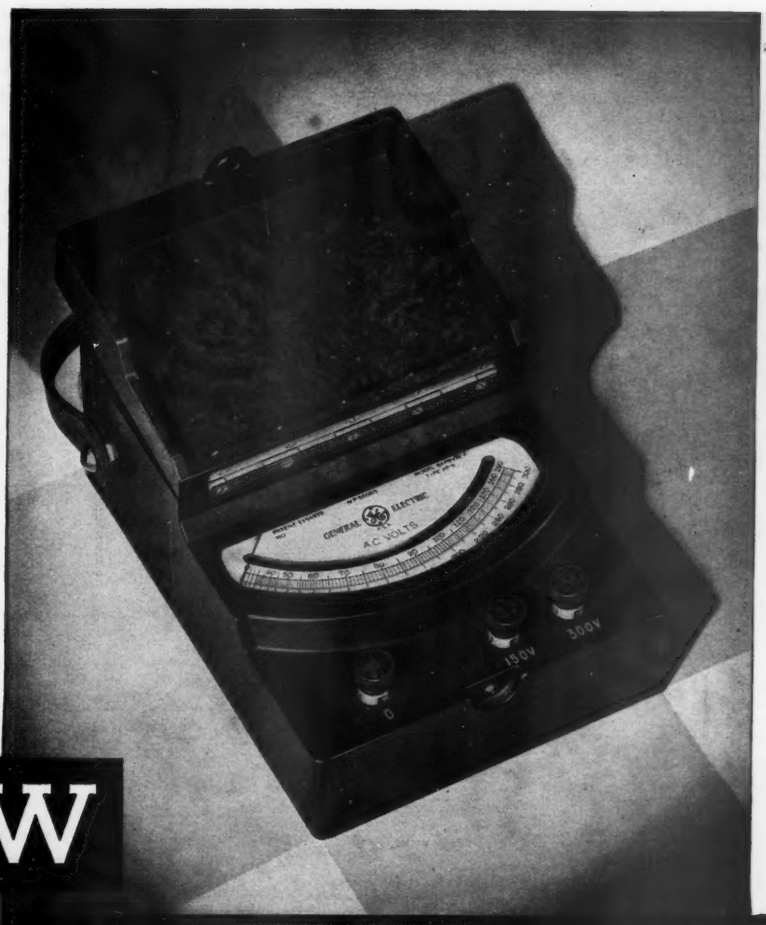
DISTANCE between centers of motor and compressor pulleys should be approximately 8½ to 9 ft. in order to secure as great an arc of contact as possible.

Pulley centers need not necessarily be on the same level, although that condition is desirable.

Normal level of the idler pulley and motor pulley centers should be approximately the same in order to secure as great an arc of contact as possible on the motor pulley to minimize slippage of the belt. Care should be exercised, however, not to allow the idler to drop so low as not to clear the bottom strand of the belt.

I believe that 24 in. would be about the proper distance between the centers of the motor and idler pulleys.

CHARLES A. PETERSON, *Electrical Department*
Bendix Products Corporation, South Bend, Ind.



Type AP-9 voltmeter, which is typical of these new G-E portable electric measuring instruments. The line includes ammeters, milliammeters, voltmeters, and wattmeters, in all standard ratings.

NEW PORTABLE INSTRUMENTS

That Will Save You Money

The nearer to maximum efficiency your motors are running, the less you are paying for electric power. Keep tabs on them with electric measuring instruments and make sure of the loads they are carrying. A power survey may show where you can make worth-while savings.

These new G-E medium-size portable instruments are ideal for such work. In both size and accuracy they compare favorably with more expensive instruments; in their ability to stand rough usage, they are much superior.

When you study them in detail and learn their prices, you will readily agree that they set a new standard of value.

Mail the coupon for Bulletin GEA-1784, which gives prices and complete information. Address the nearest G-E office, or General Electric, Dept. 6P-201, Schenectady, N. Y.

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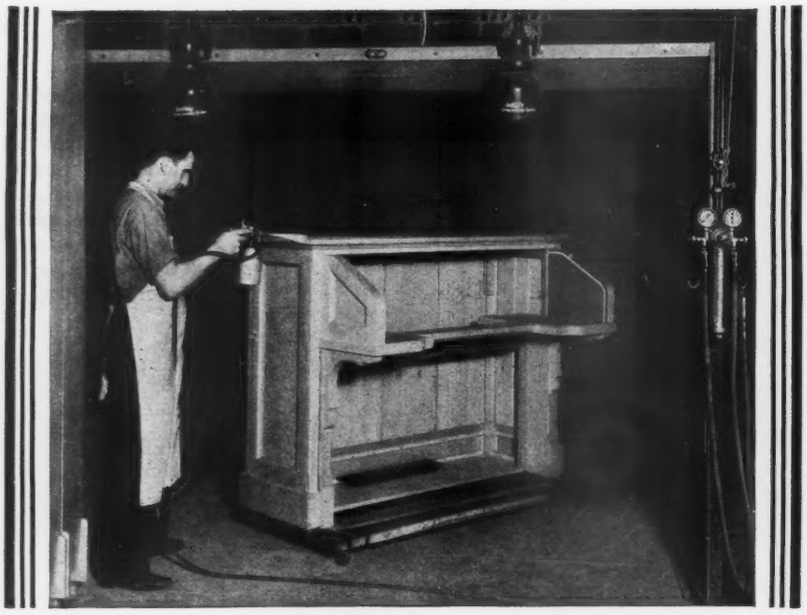

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(Continued from editorial page 518)

BEARING APPLICATIONS — Loose Leaf Folder, "Medart - Timken Engineering Journal."—The Medart Co., St. Louis, Mo.

DUST COLLECTOR—Folder, "Check Dust." —Pangborn Corp., Hagerstown, Maryland.

FENCE—Booklet, "Stewart Fences, The Ultimate in Protection."—The Stewart Iron Works Co., Cincinnati.

LIGHTNING ARRESTERS—Booklet, "Interconnection."—Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

MOTOR APPLICATION—Chart showing 29 types of electric motors and listing proper motor for fifty standard applications.—The Louis Allis Co., Milwaukee, Wis.

MOTORS, GENERATORS—Booklet, "Crocker Wheeler Products," including motors, generators, motor-generators sets, etc.—Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

PUMPS—Bulletin 150, "Morris Double-Suction High-Speed Pumps."—Morris Machine Works, Baldwinsville, N. Y.

RUBBER GOODS—Booklet, "Firestone Mechanical Rubber Goods."—Firestone Tire & Rubber Co., Mechanical Rubber Goods Division, Akron, Ohio.

SCREWS, BOLTS, NUTS—1934 Catalog, includes reference tables giving information on American National Standard Screw threads and tolerances.—Pheoll Mfg. Co., 5700 Roosevelt Road, Chicago.

BOOKS

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R. J. Monteith, former member, Federal Purchasing Board, and A. S. Burack, Manager, Government Sales Division, Bay State Mailing Service. Bruce Humphries, Inc., Boston, Mass. Text 278 pages, appendixes A & B 62 pages, indexed. $10.

Answers the who, what, when, where, and how of a market that in the coming year may easily total $1,000,000,000.

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Samuel Crowther. Doubleday, Doran & Company, Inc., Garden City, N. Y. 340 pages. $2.

Why we can row our own boat and are we going to do it?

•

REPORT OF THE NATIONAL SCREW THREAD COMMISSION

Bureau of Standards Miscellaneous publication No. 141 (order from Superintendent of Documents, Government Printing Office, Washington, D. C.). 171 pages, indexed. 56 figures. 15 cents.

Fourth edition. Includes revisions and alterations to standards as approved April 10, 1933.

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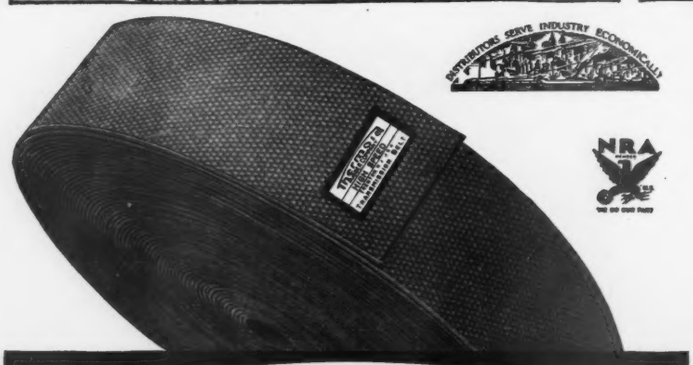
WELL I'M A CHINAMAN !
SO DO WE !



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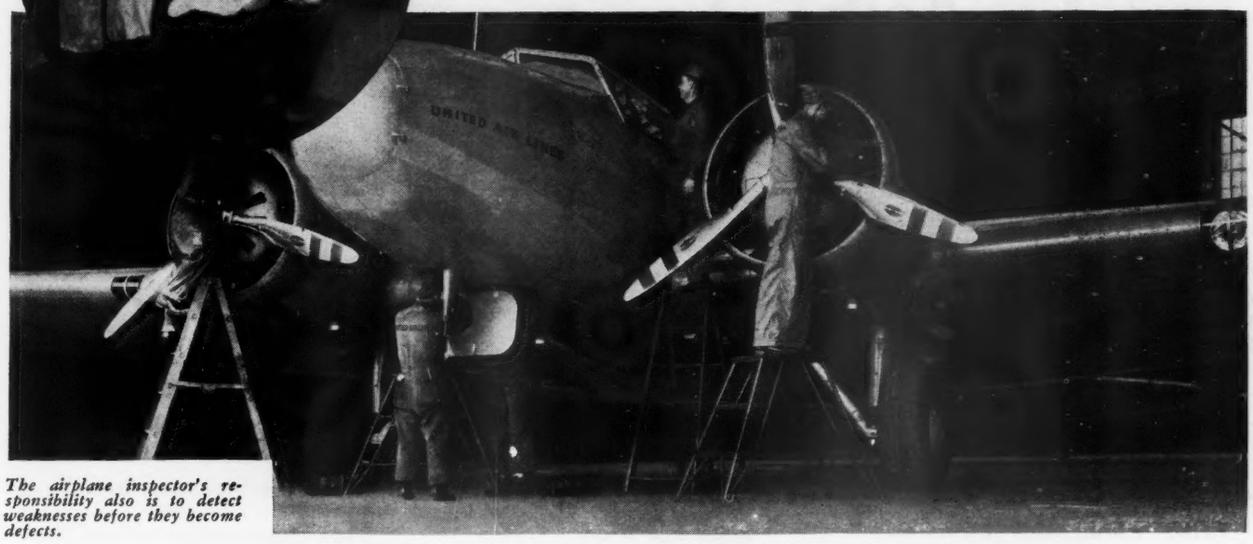
The Barrett Roof Inspector looks for hidden flaws. His responsibility is to stop trouble before it appears.

THE BARRETT INSPECTOR



The airplane inspector's responsibility also is to detect weaknesses before they become defects.

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CAREFUL and complete inspection by qualified experts is the best assurance that obvious weaknesses will be spotted and hidden defects discovered. In an airplane a weak strut, loosened wing covering, a leaking oil or fuel line—in a roof an open seam, a defective flashing, a loose connection.

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A tool crib to one of the bosses: "You're losing money here."

Answers the boss: "What do you mean?"

Crib: "I hold tools you fellows have completely forgotten about. Our plan of handling tool requisitions and returns tells you nothing about your tool investment, but there is a method that tells everything you need to know."

Boss: "What method? What will any method tell us that we do not know today?"

Crib: "Plenty! Listen—with the McCaskey Tool Checking System in here—

"You instantly locate tools by referring to the McCaskey Register.

"The boys will handle twice the number of tool requisitions and returns in an hour that they do now.

"You will have a record of usage on every tool.

"You will reduce your tool inventory THOUSANDS OF DOLLARS by eliminating tools not used.

"You will reduce the number of tool cribs through this inventory-reduction. There are fourteen of us in this plant now.

"You will make record of all broken and worn out tools.

"You will charge the proper department with tool breakage and tool wear.

"You will check excessive breakage by any workman.

"You will check each workman once a month for accumulation of tools not in use—a thing you cannot do now.

"These are results which have saved other firms many thousands of dollars—can't you use that money other places, Boss?"

Boss: "You know I can—I'll at least write McCaskey and get their information on how we can improve our situation here."

This conversation might have taken place between General Foreman O. J. Dansereau and one of the Sullivan Machinery Company (Claremont, N. H.) tool cribs early in 1927. A McCaskey Tool Checking System installation was made in June of that year. According to Mr. Dansereau they realize today every result the crib claimed for the McCaskey when he talked to the boss. They reduced numbers of cribs from 14 to 9. They saved money on the investment in tools. They saved money on time spent in handling tools. They saved money on losses, accumulation and idleness of tools.

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INDUSTRIAL DIVISION 1123

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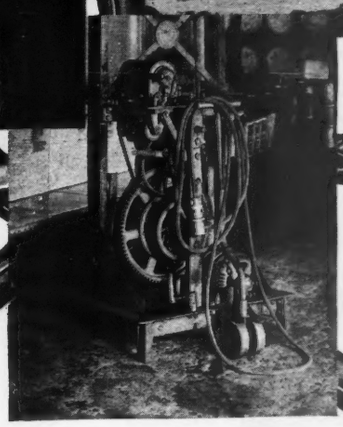

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U.S. PATENTS NOS. 1,865,415 - 1,865,416

FLEXIBLE RUBBER COVERED WIRE

does more to put PORTABLE ELECTRIC TOOLS and MACHINERY on a basis of dependable service satisfaction than any other one thing. A good tool becomes a profitable workman when you equip it with a cord that keeps it on the job. "Super Service" is that kind of a cord. Think of it, identify it and requisition it by name.

GENERAL CABLE

NRA MEMBER WE DO OUR PART

GENERAL CABLE CORPORATION

420 LEXINGTON AVENUE, NEW YORK CITY • OFFICES IN PRINCIPAL CITIES

Certainly YOU *can make a* PROFIT *today*

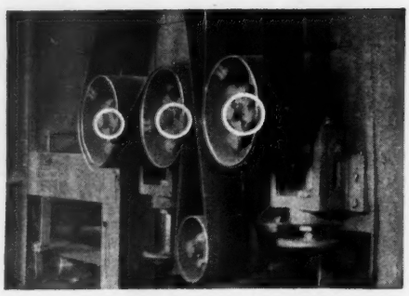
Increased labor costs...increased material costs...and under the NRA a manufacturer must sell at a profit. Small wonder that fears beset those plants with obsolete, high production-cost machinery. They are faced with the problem of obtaining low costs with certain factors inflexible. There is only one answer—modernize.

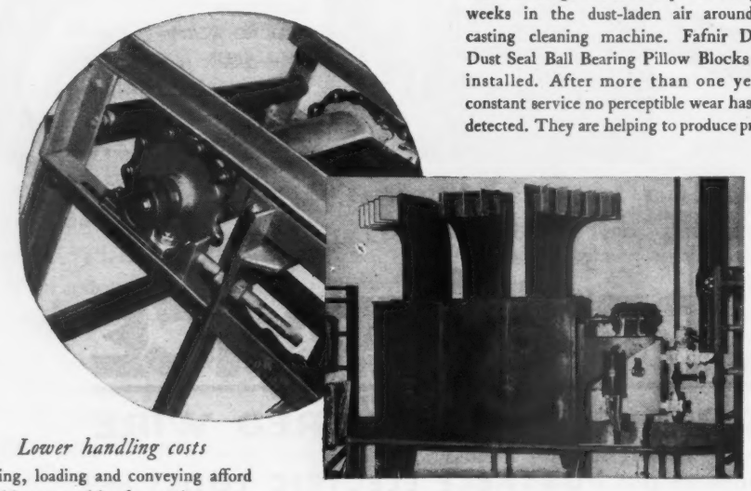
Developments in equipment to secure profit from lessened production have been speeded through the past three years. The machinery manufacturers have reduced waste by banishing friction, by increasing their machines' production capacity, by building equipment of greater and more enduring accuracy. Through the use of this equipment you *can* assure profit.

Take the case of—

26 times the life in severe service

These bearings had to be replaced every two weeks in the dust-laden air around this casting cleaning machine. Fafnir Double Dust Seal Ball Bearing Pillow Blocks were installed. After more than one year of constant service no perceptible wear has been detected. They are helping to produce profits.





Lower handling costs

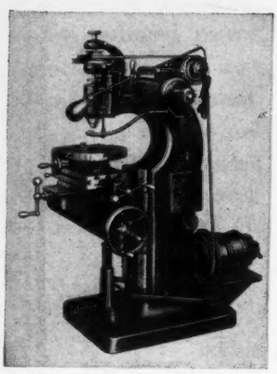
Lifting, loading and conveying afford untold opportunities for cutting costs. Mathews Conveyor Company is an outstanding contributor who in turn has been aided by Fafnir Ball Bearings.

Ball bearing unit heaters for economy

Low in original cost, easy to install and efficient in operation. That is, briefly, the story of unit heaters such as this Clarage unit. Significant is the fact that so many of these builders use Fafnir Ball Bearings to guarantee uninterrupted efficiency.

Speed, accuracy and finer finish

That's what Reed-Prentice delivers with this vertical miller using preloaded Fafnir Ball Bearings. The costly danger of spoilage is practically banished—and that in itself can often help to make a profit.



Economies through modern machines and equipment modernization is the theme of Fafnir's house organ. It's yours regularly on request.

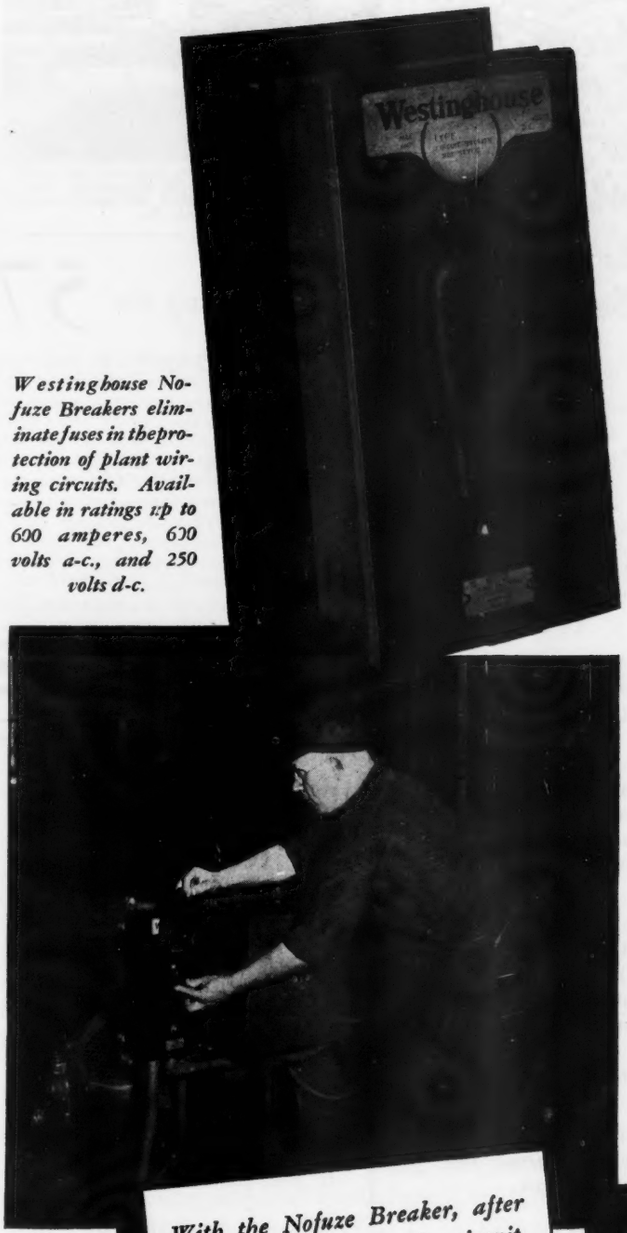
Whether it be a new machine or an old one, put Fafnir Ball Bearings to work to banish friction and wear. Save in production and the possibilities of making a profit increase. Our engineers will be glad to help you. THE FAFNIR BEARING COMPANY, *New Britain, Conn.* Atlanta...Chicago...Cleveland...Dallas...Detroit ...Los Angeles...Milwaukee...Minneapolis...New York...Philadelphia.

FAFNIR BALL BEARINGS

Safer

LOWER-COST CIRCUIT PROTECTION

with Nofuze Circuit Breakers



Westinghouse Nofuze Breakers eliminate fuses in the protection of plant wiring circuits. Available in ratings up to 600 amperes, 600 volts a-c., and 250 volts d-c.

THE Westinghouse Nofuze Industrial Circuit Breaker, which replaces the conventional fused safety switch, is absolutely safe for anyone to operate. After an overload, a mere flip of its handle restores power instantly.

All live parts are totally enclosed. There are no blown fuses to be removed and replaced . . . no testing or experimenting is required to locate the open circuit. The handle of the breaker in its "TRIPPED" position indicates the open circuit.

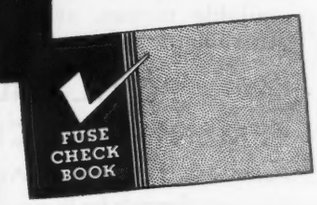
You can have fuseless circuit protection at surprisingly low cost.

Investigations made in several average plants show that money spent on fuses, and the cost of time wasted by idle men and machines when fuses blow, will pay for equipping a plant with fuseless protection in a very short time.

Check Fuse Wastes this Easy Way

Check this waste in your plant! A supply of *Fuse Check Books,* which makes it a simple matter to keep fuse-outage cost records, will be sent on request. Let your own records show you how Nofuze breakers will soon repay their cost.

With the Nofuze Breaker, after an overload opens the circuit, stopping a machine, a mere flip of the breaker handle restores service.



This check book makes it easy to keep an accurate record of lost time and money caused by blown fuses in your plant.

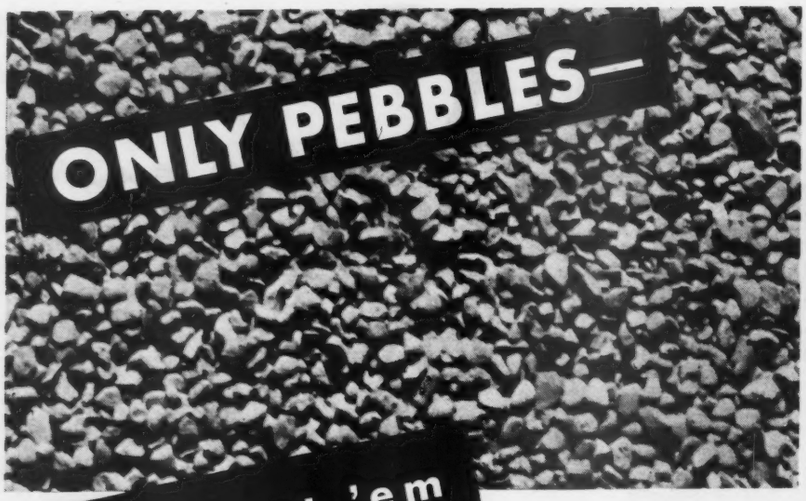
SEND FOR CHECK BOOKS

Westinghouse Electric & Manufacturing Company
Room 2-N—East Pittsburgh, Pa.
Gentlemen: I would like to investigate my fuse costs. Please send the booklet on Low Cost Circuit Protection and copies of Fuse Check Books.

Name .....
Company .....
Address .....T 79680
City ..... *State* .....FM&M 12-33

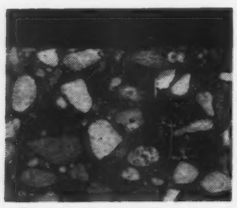
Westinghouse

Quality workmanship guarantees every Westinghouse product



This is the kind of aggregate—$\frac{1}{8}$" to $\frac{3}{8}$" size—that you want at the surface of your floor, to take the punishment of traffic.

If you want your floors to last longer—cost less—and speed factory traffic



A cross section of a modern concrete floor —note how the coarse aggregate extends right up to the surface.

●

Here is the whole story in a nutshell. Write for this valuable booklet.

Durable, smooth factory floors need no longer be a matter of chance. Here's a way to be *sure* that your next floor will be free from scale and dust—that it will cut down maintenance costs, provide a stable foundation for machinery, a sure-tread surface for workers, a smooth road for factory traffic.

See that a proper proportion of coarse aggregate (either small pebbles or crushed rock) is included in the surface mixture of your concrete. That's the real secret of enduring floors—simple, costs no more than the old-fashioned method.

We can help you with your next job. Complete specifications are available to you, gratis. Send for this valuable information, now.

PORTLAND CEMENT ASSOCIATION
Room 1312, 33 West Grand Avenue, Chicago
Concrete for Permanence

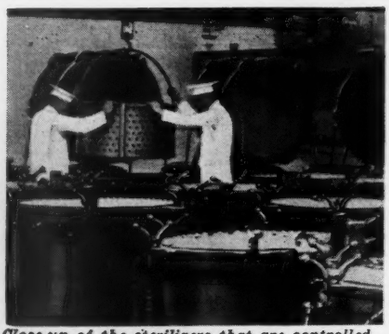
PORTLAND CEMENT ASSOCIATION
Room 1312, 33 West Grand Avenue, Chicago

Please send me your new book "Concrete Floor Finishes."

Name .....

Address .....

City ..... *State* .....



Close-up of the sterilizers that are controlled by thirty-two BRISTOL'S Recording Thermometers, installed in H. J. Heinz Company, Pittsburgh, Pa.

32 *serving the* 57

These thirty-two BRISTOL'S Recording Thermometers are in one department of H. J. Heinz Company. They are convincing evidence of the favor in which BRISTOL'S equipment is held by this well-known manufacturer. ¶Although of extreme sensitivity, BRISTOL'S Recording Thermometers possess practicability to meet every day needs. They are so diversified in design, range and application that there are models for all thermometer requirements. ¶Write for our latest Catalogue 1204-FI.

THE BRISTOL COMPANY, WATERBURY, CONN.

TRADE MARK
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Do You Read a Routed Copy?

If you are on a route list to read Factory Management and Maintenance, you probably pass it along without having the chance to read just the article that you would like best. Routed copies have a knack of arriving at inconvenient times—late—and often in poor condition.

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330 West 42nd Street, New York City

Again

G-E Gear-motors

Cut Installation Costs

•

Save Plant Space

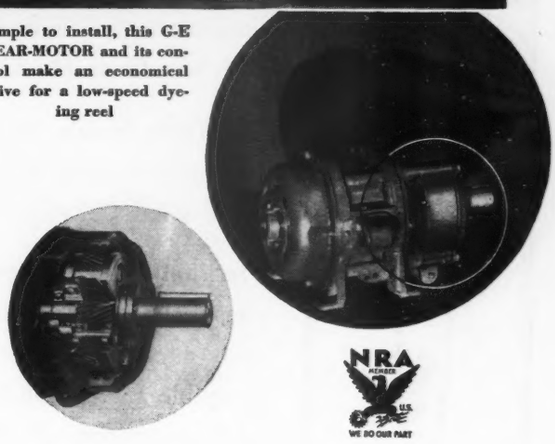
•

Reduce Maintenance

A SOUTHERN textile mill needed a low-speed drive for a dyeing reel. Because of the machine's location, the installation of a standard motor with the necessary counter-shafting would have been difficult as well as expensive. Moreover, the pulleys and belts would have cut off valuable light from the windows.

A G-E gear-motor solved the problem. It simplified installation, required less space, and reduced maintenance costs. It was a profitable investment.

You, too, can profit by taking advantage of our experience and our complete line of equipment in applying the RIGHT MOTOR and the RIGHT CONTROL to every textile machine. We shall welcome an opportunity to work with you—to help you with your drive problems. Simply write or call the nearest G-E office, or General Electric, Dept. 6B-201, Schenectady, N. Y.



Simple to install, this G-E GEAR-MOTOR and its control make an economical drive for a low-speed dyeing reel

Wherever you need a dependable, efficient, low-speed drive for either direct connection or belting to your machines, use G-E gear-motors. They are available in speeds of from 600 down to 13 rpm. They combine the economies of normal-speed motors with the efficient speed reduction of helical gearing running in oil. Gear-motors deliver the full rated horsepower of the motor at the output shaft.

200-739

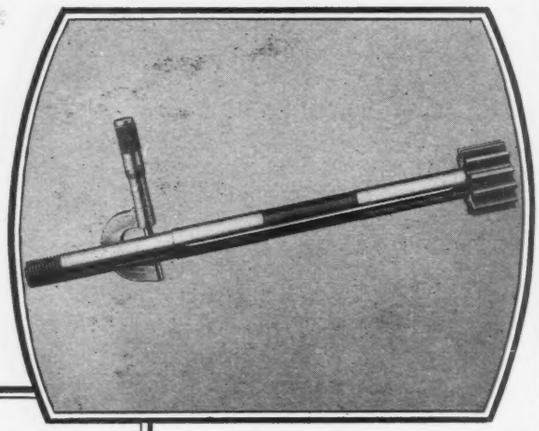
GENERAL ELECTRIC

ACCURACY—PRECISION!

the keynote of quality in

TRADE **YALE** MARK

CHAIN HOISTS



The YALE CHAIN HOIST
Driving Pinion and Gear

YALE One Ton
Spur-Geared Chain Hoist

WOULD you expect to find such mirror-like finish on the individual parts of a Chain Hoist?

The Drive Pinion is carefully ground to a working tolerance of .001 in.

Precision and accuracy of construction and finish of each integral part are responsible for the efficiency and endurance of Yale Chain Hoists and Trolleys.

Absolute uniformity is assured, for every production operation is under the hand of an expert.

Be sure the hoist you buy is marked YALE—*"From Hook to Hook a Line of Steel."*

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION
Philadelphia, Pa., U.S.A.

Makers of Yale Electric and Hand Chain Hoists, Trolleys, Electric Trucks, and Hand Lift Trucks.

IT HAPPENS IN THE BEST REGULATED BUILDINGS

FUNNY A FINE BUILDING LIKE THIS DOESN'T SUPPLY TOWELS
WE USE THE TOILET PAPER ON THAT ROLL
I'LL BET MOST OF THIS ROLL TOILET PAPER IS USED FOR TOWELS
YES—THEY'RE PAYING FOR TOWELS AND DON'T KNOW IT
SAY BILL, THE TOILET PAPER USED HERE FOR TOWELS MUST COST A LOT
YES, THEY'RE REALLY PAYING FOR GOOD ONLIWON TOWELS, BUT NOT GETTING THEM
WELL, I'LL CHANGE THAT —WHAT A MESS
THESE NEW ONLIWON TOWELS SURE ARE SWELL
YES, AND I ALSO LIKE THE ONLIWON CABINET TOILET TISSUE THEY'VE INSTALLED. BILL SAYS THE COSTS ARE LOW, TOO.

MANY building operators who do not provide Onliwon Towel Service in their washrooms are really paying for it just the same. The tenants are using the toilet paper to dry their hands and thinking about the poor service.

These days no one can afford to have dissatisfied tenants. Equip all your washrooms with individual clean, fresh, A. P. W. Onliwon Towels. These double-folded Onliwon Towels are doubly absorbent and strong—safe and sanitary. One Onliwon Towel does the work of several ordinary towels. Every one will be pleased.

Also install Onliwon Toilet Cabinets with Onliwon Tissue. These neat cabinets protect the tissue from dust and dirt. They prevent waste and theft by dispensing only two sheets at a time.

A. P. W. Onliwon Washroom Service will pay you dividends in the form of tenant satisfaction. Order it for your building. The present low cost will surprise you.

A.P.W.

ONLIWON SANITARY WASHROOM SERVICE

A. P. W. Paper Co., Albany, N. Y.
Representatives in leading cities

A National Movement

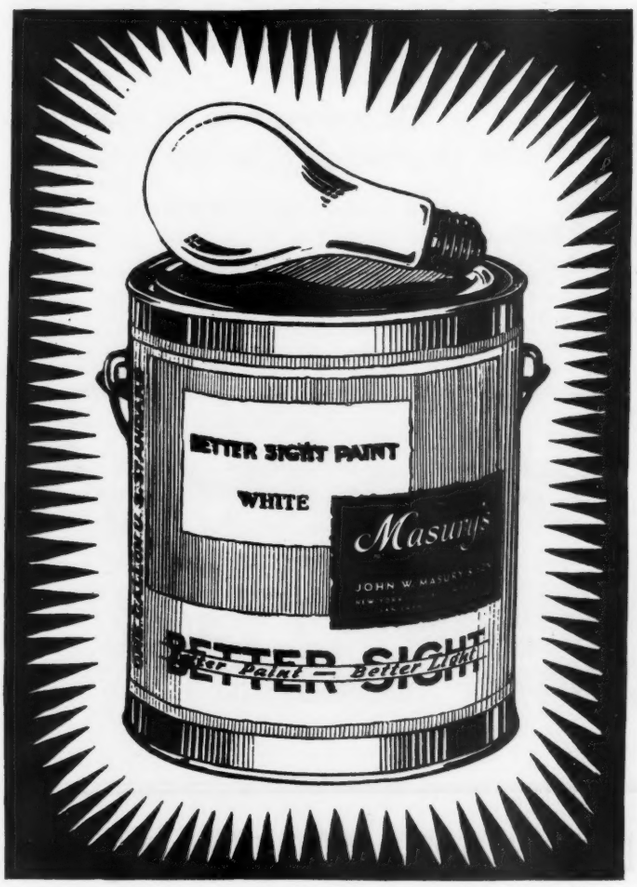
■ Sponsored by the Edison Electric Institute, the electric utilities of the country are conducting an elaborate campaign for *better seeing conditions* wherever people congregate for work, play or study.

Seeing is a partnership of light and vision; a most important partnership.

Scientists claim that fully one quarter of human energy is consumed in the process of seeing.

Hence the importance of adequate seeing conditions where human energy is necessary for production, as in factories.

Welcome the visit of your local utility man who will, with direct reading instruments record, in your presence, the status of the seeing conditions in your plant and office, as a result of your natural and artificial lighting and the paint on walls, ceilings and equipment.



for permanence in paint

The effectiveness of any lighting improvement must take into account the reflective properties of the paint, plus that equally important consideration: the *permanency* of that reflection factor. The Masury laboratories have cooperated in the "Better Light—Better Sight" movement by developing paints with qualities essential for this most important work.

JOHN W. MASURY & SON
50 Jay Street
BROOKLYN, NEW YORK
..... *Since 1835* .....

Right Now. . . .

There's something new in

"Change" is the big word today. Change in politics, economic set-ups, business and industry. Change is burying last year's business ideas and methods—giving birth to new and better ones.

Production is changing with new machinery, new methods, new materials taking the place of the old. Distribution is changing with new uses and markets, new sales and competitive rules and methods.

The companies that expect to keep pace in days like these must be on their toes, must know what's going on today, must be prepared to take advantage of every new and better way of doing the new jobs.

The best way to do this is by having your business paper keep you and your staff in touch regularly with the situation.

McGRAW-HILL PUBLISHING COMPANY, Inc.

your field . . . Will you hear of it in time?

Put Yourself and Your Company on a "Keep Alert" Program

No half-hearted, occasional reading will do it. For today's progress isn't occasional—it's moving constantly with almost dizzy speed. It calls for a constant program of alertness along these lines:—

(1) Keep up with all the latest developments in your own profession, business or industry by reading regularly the leading paper in your field of endeavor.

(2) See that your department heads read regularly publications pertaining to their own jobs, whether in management or operation, production or maintenance. (See list of Publications opposite.)

(3) Ask to have a McGraw-Hill representative explain the various editorial features and services of the publications.

(4) Keep in touch with the McGraw-Hill Book Company for the latest treatises on business and technical subjects.

McGraw-Hill Publications and McGraw-Hill books form the clearing house for new ideas in almost every field. Study the list on this page. Ask yourself *frankly* which ones you ought to be reading, which ones your department heads ought to have. Send for the McGraw-Hill Book Catalog, and make sure you're not missing any information that can help you in your business.

These magazines and books belong on your "required reading list" just as much as your daily paper. Read them . . . see that your staff reads them . . . keep your company alert. For the company that's alert today will be among those present tomorrow!

American Machinist . . . for machinery and metal product manufacturers . . . business and technical magazine of the metal-working industries.

Aviation . . . covers all business and technical developments in private and industrial flying, including production, operating, and maintenance.

Bus Transportation . . . for executives of transportation companies operating and maintaining buses in common carrier service.

Business Week . . . gives the busy executive all important and significant business news in one publication . . . quickly . . . accurately . . . tersely.

Chemical and Metallurgical Engineering . . . for the chemical engineer . . . covers production, technology, marketing, finance, economics, and management.

Coal Age . . . devoted to the operating, technical and business problems of mining and marketing coal.

Construction Methods . . . an illustrated review of current field practice and equipment used in all general and special construction activities.

Electrical Merchandising . . . serves the electrical appliance trade . . . electrical retailers and wholesalers . . . helps them become better merchants.

Electrical West . . . serves the specific interests both of engineering and of selling in the electrical industry of the eleven Western States.

Electrical World . . . for electrical engineers . . . weekly business and technical coverage of electrical industry activities, including all phases of generation, distribution, and utilization of electricity.

Electronics . . . industrial design, engineering and manufacture of radio, sound, and communication equipment. Features new applications of electronic tubes.

Engineering and Mining Journal . . . complete and authoritative technical and market publication of mining, milling, smelting and metal refining industries.

Engineering News-Record . . . leading weekly publication of civil engineering and construction, covering news and technical performance.

Factory Management and Maintenance . . . all phases of plant operation . . . management, production and services including maintenance of electrical and mechanical equipment.

Food Industries . . . production, operation, engineering, and distribution in food manufacturing and processing plants of all kinds.

Power . . . every phase in the production and transmission of power in any form, including all prime movers, and auxiliary equipment.

Product Engineering . . . for engineers and executives who create, design, and develop machinery and "engineered" metal products.

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Model WW-64. 1200 r.p.m. maximum speed—85 c.f.m. displacement. Timken Bearings—All-pressure Lubrication — Connecting Rods, Lynite Forgings.

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If you are considering a new location for your New York sales office or show room the following details concerning the McGraw-Hill Building, 330 W. 42nd Street, will interest you:

Acres of ¼ inch plate glass are used in 4000 windows to flood 33 floors with sunshine. Light-protected on all four sides.

Entirely fireproof, with every floor protected by automatic sprinklers, tenants are assured the lowest possible fire insurance rates.

Service of highest quality provided by the building management. Building is never closed. Watchmen and elevator service 24 hours a day. Cleaning service includes polishing of floors, desks and windows.

Weather-protected loading platform accommodates 11 trucks. Four freight elevators.

The new McGraw-Hill Building is right in the hub of interborough rapid transit lines. Three different subway systems converge at its doorstep.

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Money from the Air

That's what we mean—actual dollars out of the air! In almost every industrial plant there are places where the installation of the right type of blower or exhauster will result in cash savings which pay for the fan and in a short time show a profit!

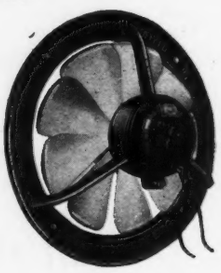
Check over the blower and exhauster equipment in your plant—see if you are paying for too much power—decide whether or not an additional fan would improve conditions in some departments.

Then call on Buffalo engineers to make their recommendations. No charge—no obligation.

Buffalo "E" Blowers and Exhausters. Sturdy cast iron or special metal housing. High efficiency wheel. Blowers used for blast to furnaces, or where relatively small amount of air or gas is required at high pressure. Flanged type shown used for gas boosting, etc.

"Baby Conoidal" Fans. Compact outfits for blowing or exhausting. Quiet, efficient, durable. Inexpensive to operate. Popular thruout industry. Complete range of sizes.

Buffalo Breezo Ventilating Fans. The ideal disk type fan for exhausting against low resistance. Fully enclosed motors. All-steel wheel and frame. High efficiency. Seven sizes.



WRITE FOR BULLETINS

BUFFALO FORGE COMPANY

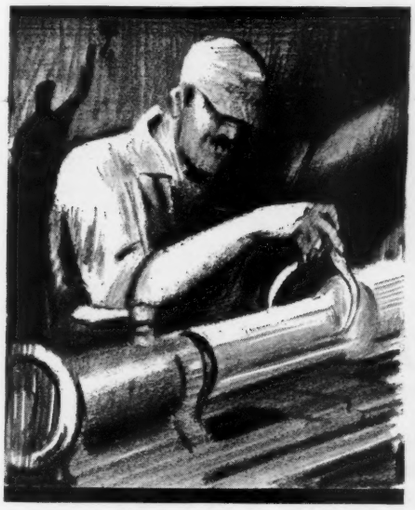
471 Broadway, Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd. Kitchener, Ont.

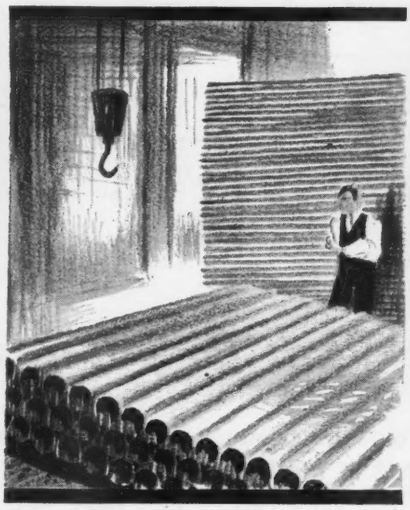
In Giving Your Customer a Square Deal—*Consider this*

Your Price to Him is Based on *Three Main Factors* . . . . . .

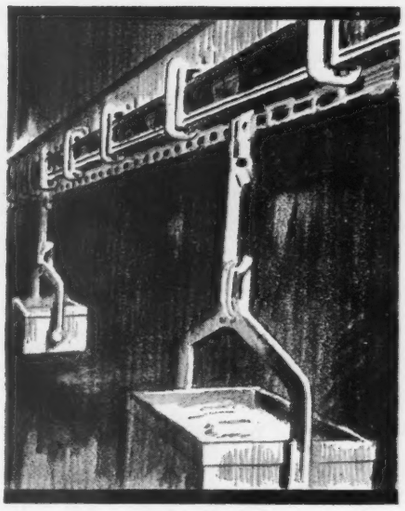
Labor Costs . . . . . Material Costs . . . . Handling Costs . . .



These are increasing—are only moderately controllable by you—but are capable of adding quality to your product.



These are also increasing—are largely beyond your control—but also affect your product quality.



Handling is pure expense, in no way bettering your product—but is directly *controllable by you.* A saving *can be made* and reflected directly to your customer.

THE service of a Jeffrey Material Handling Specialist is yours to command. He will inspect your plant and recommend the best and most economical equipment to effect this saving.

This is the one factor where your control *is definite*—where your costs *can be cut* and your saving reflected directly to your customer.

You owe that customer this service.

THE JEFFREY MANUFACTURING COMPANY
911-99 North Fourth St., Columbus, Ohio

New York	Philadelphia	Cincinnati	Huntington, W. Va.	Salt Lake City
Buffalo	Pittsburgh	Cleveland	Milwaukee	Birmingham
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	Boston	Chicago	Denver	

JEFFREY MANUFACTURING COMPANY, LTD., OF CANADA
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NRA MEMBER U.S. WE DO OUR PART

JEFFREY
MATERIAL HANDLING EQUIPMENT

Almost here!

JANUARY 1934

A New Year for Business

Must business wait for advertising budgets?

When the 1934 race for sales begins, will your company be off at the crack of the gun? Or will your sales drive have to wait, because your publication advertising budget didn't provide for getting started in the early January issues of business papers.

We needn't remind you that competition is going to be keen in 1934. That immediate advertising is needed to start January sales. That the companies with a head start on the rest of the field will be just that much to the good.

You executives who read this have the power to get your advertising managers started *without a formal budget.* Business can't wait on budgets. Give them your O.K. *now* to go ahead with the advertising portion of your sales promotion program.

1934 ought to be a better year for business. It will be,—if you make it a *12-month year*—if you pack each month full of effective sales effort — *preceded by* aggressive advertising effort.

Note that January issues close in December — and closing dates are right at hand. Check up with your advertising manager—NOW!

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Bus Transportation
Business Week
Chemical and Metallurgical Engineering
Coal Age
Construction Methods
Electrical Merchandising
Electrical West
Electrical World
Electronics

Engineering and Mining Journal
Engineering News-Record
Factory Management and Maintenance
Food Industries
Metal & Mineral Markets
Power
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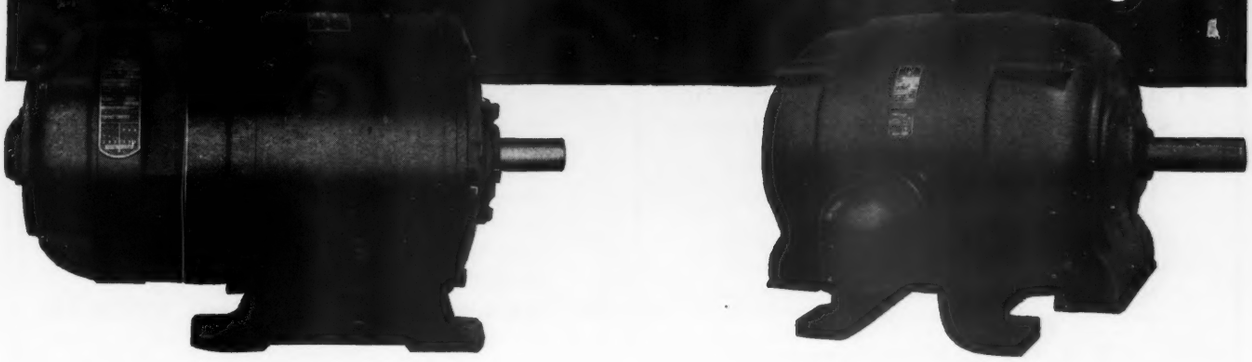
Radio Retailing
Textile World
Transit Journal

For unusual drives···
TWO ANSWERS!



GEAR MOTORS

from 2 revolutions per minute up

Where standard motor speeds are too high—where you need a compact, simple, slow-speed drive—*there* is where you need a Fairbanks-Morse Gear Motor.

The F-M Gear Motor is the same high quality F-M Ball Bearing Motor with standard NEMA frame, built integrally with a 97% efficiency speed reducer which is also equipped with anti-friction bearings.

Either motor or gear assembly may be removed for inspection or repair *quickly*—and re-alignment is positive and accurate due to an indexed fit between the two units.

Cost is considerably less than the conventional motor, coupling and gear box assemblies.

Complete information mailed immediately on request.

SPLASH-PROOF MOTORS

Protected Against All Liquids and Falling Particles

Something new in practical design of splash-proof motors—and far superior to the usual "adaptation" to this kind of service. From its very beginning, the F-M Splash-Proof Motor was designed to be what it is named—splash-proof—fully protected against steam, water or other liquids which may be directed toward it and against all falling particles.

The only openings are the flared air ducts which open at the bottom slightly above the level of the motor feet.

These air ducts are fitted with removable, perforated baffles which prevent the entrance of any water which may be directed into them.

The design of these baffles is such that resistance to air is negligible. Cooling air is equally and thoroughly distributed, resulting in a sweet running motor with no "hot spots."

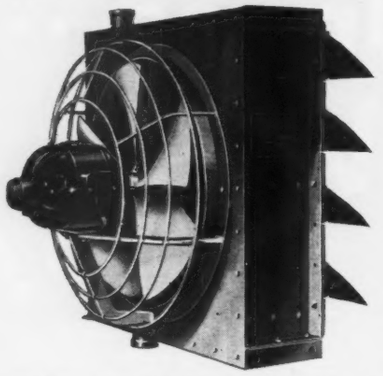
Want to read all about a truly Splash-Proof Motor? Send for descriptive bulletins just off the press. Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Illinois.

FAIRBANKS-MORSE
MOTORS

5920-EA40.56

POWER PUMPING AND WEIGHING EQUIPMENT

WING UTILITY UNIT HEATERS



WING UNIT HEATERS offer the Simplest Solution of Your Heating Problems

You may not have to consider a complete new heating layout but may have certain areas or departments where the heat is spotty and where your men hate to work on cold days. If so the installation of one or more Wing Unit Heaters will solve this problem, quickly and inexpensively.

L. J. WING Mfg. Company
162 W. 14th St., New York City
Specialists in Air Handling Equipment Since 1878
Wing Utility and Featherweight Unit Heaters, Fans, Blowers, Exhausters and Steam Turbines

Speed?

If *speed* is of major importance in the hoist you select the Wright "WH" Electric Hoist meets this requirement. If limited headroom is a condition in your plant, Wright "WH" Electric Hoists require only eleven to thirteen inches below the runway beam.

For modern design, rigid construction, efficient operation and long life, select a WRIGHT. Send for complete information today to

WRIGHT MANUFACTURING DIVISION
of the American Chain Company, Inc.
York, Pennsylvania

NRA WE DO OUR PART

WRIGHT HOISTS

ACCO

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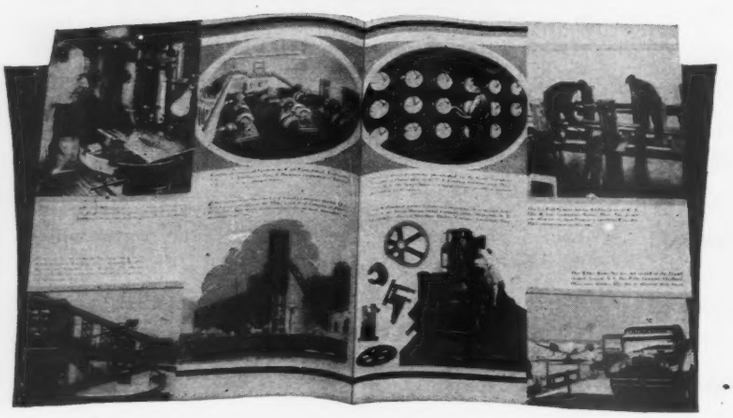

made on the job tell the story!

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PRODUCT ILLUSTRATIONS
EQUIPMENT PHOTOGRAPHS
INSTALLATION SCENES
PROGRESS PHOTOGRAPHS

Send for this descriptive folder

FIELD PHOTO SERVICE
McGraw-Hill Publishing Company, Inc.
330 WEST 42nd STREET, NEW YORK

WHETHER it's a product or piece of equipment to be sold, a report to be illustrated, or the progress of a job to be recorded, actual photographs tell the story better than words . . . Here is a photographic service prepared to secure first class pictures, promptly and at minimum cost, through carefully selected commercial photographers in all parts of the United States and Canada.

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Equipment, Materials and Supplies for Plant, Mill and Factory

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30 Church St. New York
INDUSTRIAL AND MANAGEMENT ENGINEERS
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Consulting Engineers
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MANAGEMENT ENGINEERS
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709 Washington St. Buffalo, N. Y.
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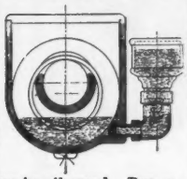
BECAUSE the consultant is free of the traditions and inhibitions which ofttimes hamper the thinking of men on the job, he is frequently able to see more clearly and offer valuable advice. Let him demonstrate to you the practical dollars-and-cents value of an "outside viewpoint" on your "inside" problems.

Run a 30-Day Test on *SpeedWay* Constant Level Oilers



Send for a dozen today. Try them on your key motors. See how they end over-oiling, stop oil-dripping, save oil. See how they cut oiling time to a fraction, pay for themselves in oil saved. Run a 30-day test and if you don't want to keep them, send them back.

SpeedWay Mfg. Co., 1832 So. 52nd Ave., Cicero, Ill.

Hydro-Proof
for Repairing or Resurfacing Industrial Floors
The Asphalt Products Co., Inc.
Syracuse, N. Y.

Zimmer sells ECONOMY in belting service
Belts are only a means to an end in Conrad Zimmer service. Our job is to design your transmission belting to save you money—in power, material and labor.
Write for details.
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PULMOSAN SAFETY DEVICES
For every industry
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- Fire Fighting, etc.

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EVERYTHING for SAFETY

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(Laminated Bakelite)
SYNTHANE CORPORATION OAKS · PENNA
Offices in Principal Cities

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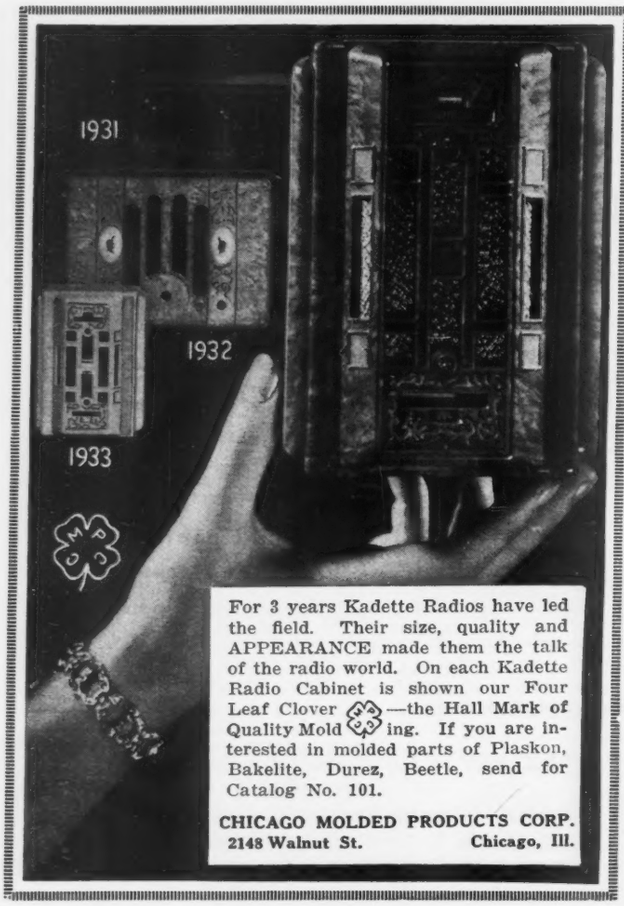
Flexible Belt Lacing

Specify STEELGRIP for Conveyor and Power Belts, for extra strength and long service. It goes on in a few minutes; requires only a hammer. It prevents belt ends from fraying and does not cut out. Made of treated steel it penetrates the toughest belting cleanly, clinches and holds. It comes in all sizes, in convenient lengths or long strips. 2-piece hinged rocker pin takes up wear.

20% Stronger

Write for Circular
Armstrong-Bray & Co.
312 N. Sheldon St., CHICAGO, U.S.A.

THE Service Section of Factory Management and Maintenance supplements other advertising in this issue with these additional announcements of products and services essential to modern plant management and maintenance. Make a habit of checking this page each issue.



For 3 years Kadette Radios have led the field. Their size, quality and APPEARANCE made them the talk of the radio world. On each Kadette Radio Cabinet is shown our Four Leaf Clover (CMP) —the Hall Mark of Quality Mold (CMP) ing. If you are interested in molded parts of Plaskon, Bakelite, Durez, Beetle, send for Catalog No. 101.

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2148 Walnut St. Chicago, Ill.

Every Kind of

STEEL

[also Copper & Brass]

In Stock For Immediate Shipment

Hot rolled bars.
Cold rolled bars incl. high speed screw and accuracy stock.
Alloy steel bars, nickel, chrome, etc.
Stainless steel sheets, bars, etc.
Sheets
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Plates, tank, boiler, cold rolled, floor, etc.
Structural steel incl. rails, H Beams, etc.
Tubes, boiler and mechanical.
Rivets, bolts, etc.
Brass, copper.
Babbitt.
Tools.

Write for the Ryerson Stock List.

Joseph T. Ryerson & Son, Inc.

Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

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An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

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SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 24 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details. R. W. Bixby, Inc., 276 Delward Bldg., Buffalo, N. Y. (F. M. M.)

FREE BULLETIN

"Rockford Rebuilt" Power Plant Equipment An 8-page illustrated stock list (8½x11) supplemented with a 2-page sheet of New Deal bargains. Issued by the Rockford Power Machinery Company, 635 Seventh Street, Rockford, Ill.

WANTED

ANYTHING within reason that is wanted in the industry served by Factory Management and Maintenance can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

EARN EXTRA MONEY

During Your Spare Time

How would you like to earn from $1 to $2 an hour for time now yielding you no profit. We have an exceptional position by which you can make money, spare or full time, without interfering with your present employment. You simply recommend and call to the attention of fellow employees and business men the most complete line of business and technical books ever published. Every kind of worker and business man finds in our books the ready reference knowledge that gives him the quick and valuable assistance in his daily work that will help him increase his daily earnings or his profits promptly and effectively and which once known about, he is eager to own. You can make ready cash quickly and easily each week by showing our lists to your associates and others. No experience required. Complete equipment, Free.

Write Tom Crawford Dept. F. M. & M.

McGRAW-HILL BOOK CO.
330 West 42d Street, New York City

"SEARCHLIGHT" IS Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"Think SEARCHLIGHT First"

G-7

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT
803 Williams St. North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: PAlisade 6-2600

MOTOR GENERATOR SETS

1—530-kw., 250-V., Westinghouse Synchronous motor Generator Set.
2—300-kw., 250-V., 1200-r.p.m., 4100-V., G. E. Synchronous Motors.
1—250-kw., 230-V., 3-ph., 60-cy., 2300-4600 Synchronous Motor Generator Set.
1—200 kw., 230-V., 3-ph., 60-cy., 2300-4100-V. Synchronous Motor Generator Set.
1—200-kw., 125-V., 3-wire, 3-unit Ridgway.
1—150-kw., 600-r.p.m., 250-V., Gen., 3-ph., 60-cy. 220-440-V., G. E. Synchronous Motor.
1—125-kw., 250-V., Westinghouse Synchronous Generator Motor Set, 3-ph., 60-cy., 230-2200-V.
2—125-kw., 125-V. G. E., 2300-V. motor.
1—100-kw., 125-V., D. C., 220-440-V., A. C. G. E. Synchronous Motor Generator Set.
1—100-kw., 250-V., Gen., 900-r.p.m., 2200-V, Synchronous Motor.
1—50-kw., 230-V., 1200-r.p.m., 220-V., Westinghouse Synchronous Motor.
2—50-kw., 125-V., 1200-r.p.m., 220-V. Westinghouse Synchronous Motor.

ENGINE GENERATOR SETS

3—200-kva. 220/440/600/2300-V. General Electric Ames Uniflow.

TURBINES

1—475-kva. Westinghouse Non-condensing.

TRANSFORMERS

4—333-kva. Pittsburgh, 4100/110/220-V.
3—200-kva. G. E., 2400/120/240-v.
4—150-kva. Westinghouse, 2400/120/240-V.
3—100-kva. Westinghouse, 2400/120/240-V.

A. C. GENERATORS

No	Kw.	R.p.m.	Volts	Ph.	Type
1	400	900	2300–4000	3	Westg.
1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230–2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220–440–2300	3	G.E.

MOTORS—3-Phase, 60-Cycle

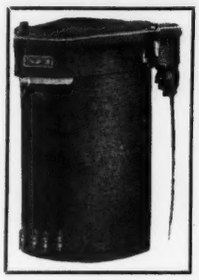
No.	Hp.	R.p.m.	Volts	Type
1	800	180	4000	Westinghse. syn.
1	600 kva	900	440	G. E. Syn. cond.
1	500	150	2300	Elec. Mach. syn.
1	500	900	440/4000	Westghse. syn.
1	500	900	440–2200	G. E. syn.
1	350	900	2200/4000	Wh. syn.
2	300	600	445–2300	G. E. syn.
1	250	600	2200/4000	G. E. syn.
1	250	600	220–440	Westg. syn.
1	250	600	440–2200	G. E. syn.
3	200	514	4150–2300	G. E. syn.
2	200	514	2300/4000	G. E. sl. rg.
4	150	1200	220/440	Westg. sl. rg.
1	150	900	2200	G. E. syn
2	150	514	2200	Westgh. sl. rg.
1	150	1800	2200	West. sq. cg. mtr.
1	100	900	440/2200	G. E. sq. cg.
1	100	900	220–440–220	Westg. sq. cg.

PUMP

1—4,000,000-gal. Water Pump Worthington engine.

Complete Line of A.C. and D.C. Motors and Generators

TRANSFORMERS



A Complete Stock. Prompt Shipment.

Special Offer for December

3—500 kva. General Electric Transformers, 60 cycle, 2400 volts, 3 phase, to 240 volts, 2 phase. **$850.00 EACH**

We Rewind, Repair and Redesign all Makes and Sizes.

ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 127-D

THE ELECTRIC SERVICE CO., INC.

AMERICA'S USED TRANSFORMER CLEARING HOUSE
STATION M CINCINNATI, OHIO

SLIP-RING MOTORS—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
700	2300	G.E.	900
220	220–440	G.E.	450
200	440–220	G.E.	600
150	2200–440–220	G.E.	514
150	220–440–550	G.E.	600
150	2200–220–440	G.E.	720
100	2200–550	Westghse.	900
100	550	G.E.	720
100	440–220	G.E.	720
75	440–220	G.E.	900
60	440–220	G.E.	900
50	2200	G.E.	514

DIRECT CURRENT MOTORS

Hp.	Volts	Speed	Make	Type
100	230	1150	G.E.	LC
100	230	625	Westghse.	SK
80	230	600	G.E.	RC
75	230	950	G.E.	RC
50	115	565	G.E.	DLC
40	230	750	G.E.	RC

DIRECT CURRENT GENERATORS

Kw.	Volt	Speed	Make	Type
225	250	900	G.E.	MPC
100	250	725	Westghse.	SK
75	250	750	G.E.	RC
50	125	725	G.E.	DLC
35	250	850	G.E.	RC

MOTOR GENERATOR SETS

1—150-kw., 250-275-V., 1200 r.p.m., G.E. connected to 225-kva., 2300-4000-V., 3-ph., 60-cy., synchronous motor.
1—145-kw., 125-V., 900-r.p.m., Westghse. connected to 285-hp., 2400-4100-V., 3-ph., 60-cy, synchronous motor.
1—85-kw., 125-V., 1200-r.p.m., Westghse. SK, connected to KT 440-220-V., 60-cy., S. C. motor.
1—65-kw., 125-V., 1200-r.p.m. G.E. RC, connected to KT, 440-220-V., 60-cy., squirrel-cage motor.
1—50-kw., 250-V., 1200-r.p.m., G.E., DLC, connected to ATI, 75 hp, 440-220-V., 60-cy. syn. motor.

A.C. GENERATORS

1—250-kva., 600-r.p.m., 240-480-V., G.E.
1—225-kva., 600-r.p.m., 2300-480-240-V., G.E.
1—225-kva., 900-r.p.m., 480-240-V., G.E.
1—150-kva., 600-r.p.m., 2200-480-240-V., G.E.
1—112½-kva., 900-r.p.m., 2200-240-480-V., G.E.
1—62½-kva., 1200-r.p.m., 480-240-V., G.E.
1—37½-kva., 1200-r.p.m., 480-240-V., G.E.

Stephen Hall & Co., Inc.

693 Adams St., Hoboken, N. J.

A.C. MOTORS—3 Ph., 60 Cy.

800-hp. G.E. Slip Ring, 2300 v., 720 r.p.m.
600-hp. G.E. Synch., 440/220 v., 360 r.p.m.
300-hp. Al.-Ch. Slip Ring, 2200 v., 525 r.p.m.
200-hp. West. Slip Ring, 440/220 v., 500 r.p.m.
200-hp. G.E. Synch., 2200/440 v., 514 r.p.m.

MOTOR GENERATOR SETS

100 kw. G.E., 3 bearing D.C., RC, 250/125 v.; A.C. 150 hp. Slip Ring, 220/440 v., 3 ph., 60 cy., 1175 r.p.m. Complete.
50 kw. West. Set; D.C., Type SK, 25 v.; A.C. Synch., 220 v., 3 ph., 60 cy., 1200 r.p.m. Note: Can be operated reverse.

Above are a few of our stock items.

MOTORS—GENERATORS—TRANSFORMERS AND ELECTRICAL EQUIPMENT

BELYEA CO., INC. 144 W. 18th St. New York City

REBUILT—GUARANTEED

Poor Aladdin . . .

The best service at Aladdin's command was rubbing a lamp and WISHING for what he wanted while YOU have the "Searchlight" at your disposal to FIND what you want!

May we serve you?

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large Stock. New and Rebuilt. All Guaranteed *Write for Stock List and Prices.*

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

PRICED TO SELL

1—8½ ft.x30 in. Bridgeford Lathe, heavy duty, motor driven quick change gears.
1—9 ft.x44 in. Boye & Emmes heavy duty, belt driven quick change gears.
1—Bement Miles Horizontal Boring Bar, 1½ ft.
9—Landis, single and double head Pipe and Nipple machines, sizes from ⅛ to 2 in.
4—200 H.P., 3 bearing Gen. Elec., 60 cy., 3 ph., 2200 v., 450 r.p.m., sl. rg., complete with switchboard and starting equipment—never been used.

ALL IN EXCELLENT CONDITION

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Catherine St. and B.&O.R.R., Baltimore, Md.

WE GUARANTEE OUR POWER EQUIPMENT

Air Compressor: New I-R — type XRE 7½ and 12 x 8 synchronous motor driven with all accessories. Twenty other sizes.
Motors: AC and DC — 1/30 to 1500 HP.
Engine-Generator Sets: AC and DC.
Belted Generators: AC and DC.
Transformers: all standard sizes.
Pumps: boiler feed, centrifugal, turbo, power.

We Are G-E Motor Dealers
Write for our latest stock bulletin

ROCKFORD POWER MACHINERY COMPANY
635 Sixth Street, Rockford, Illinois

GREGORY
ESTABLISHED 1893
Hi-Grade Rebuilt

Motors, Generators, Welders, Platers, Converters, Meters, Transformers, Pumps, Exhausters, Blowers, etc. All Standard Makes, Money-Back Guarantee.

LATEST ROCK BOTTOM PRICES

GREGORY ELECTRIC CO.

W. 16th at Lincoln St. CHICAGO

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SKILSAW

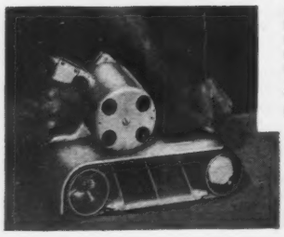
OF MAINTENANCE, PACKING AND OPERATION WITH THIS PORTABLE ELECTRIC SAW!

●There are dozens of uses for Skilsaw in your plant, and all will save money! Skilsaw will cut off 22 ft. of 7/8" crating lumber in *60 seconds*, compared with *18 minutes* for hand sawing. Will rip 12 ft. of 2" plank in *20 seconds*. Will rip 60 ft. of 7/8" maple flooring in 3 *minutes*, compared with *4 hours* with a hand saw. Opens crates without touching goods, with big savings in crate salvage. Also cuts stone, metal and compositions. Accurate, powerful, easy to use, light weight, reliable. Made in six sizes.

For information and prices write

SKILSAW, INC.
3318 ELSTON AVE. CHICAGO

SAVE MONEY--CUT OUT COSTLY HAND-SANDING



●Skilsaw Sander will show you amazing performance for both production and maintenance. Sands, grinds and polishes wood, metal or stone. Perfect balance and wide sanding belt enable beautiful work. Full ⅝ H.P. Motor, yet weighs only 18 lbs. Write for information about its many applications.

SKILSAW SANDER

KEEPING IN STEP WITH THE Recovery PROGRAM

The modern, high speed belt lacer produced by Clipper today is a development of over a quarter of a century of intensive specialization. You will find it one of the answers to the problem of adjusting costs to meet a higher wage scale.

Clipper Hooks are 20 to 30% lower in price than any hook made in America yet they are unsurpassed in quality and durability.

Clipper Lacing Equipment

Clipper Belt Lacer Co. Grand Rapids, Michigan

SURE CURE...
for One Kind of COLOR BLINDNESS!

DON'T blame workers for off-shade lots or batches if textiles, paints or other colored products must be matched under light from ordinary lamp bulbs. Even the best of eyes may seem color-blind in light that's not pure white.

Hygrade Daylight Lamps show all colors in approximately true values. In textile mills their light has proved invaluable also for revealing fabric flaws more quickly.

Daylight Lamps are only one of many quality Hygrade Lamps that have proved their unusual dependability by long service in every industry. Made in all types and sizes, Hygrade Lamps are used today by such exacting buyers as great textile and steel mills; shoe, rubber and packing plants; coal mines, railway systems, offices and public buildings. They meet U. S. Government standards. Hygrade Sylvania Corporation, Salem, Mass.

● TOUGH SPOTS IN FACTORY LIGHTING

Supt.: "Why are all these pieces coming through off-color?"

Foreman: "It's the light. Give us daylight lamps and you'll save money!"

HYGRADE
LAMP BULBS

A PRODUCT OF HYGRADE SYLVANIA CORPORATION

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START NOW to MODERNIZE *Your Electrical Equipment* ...DO IT BY DEGREES...

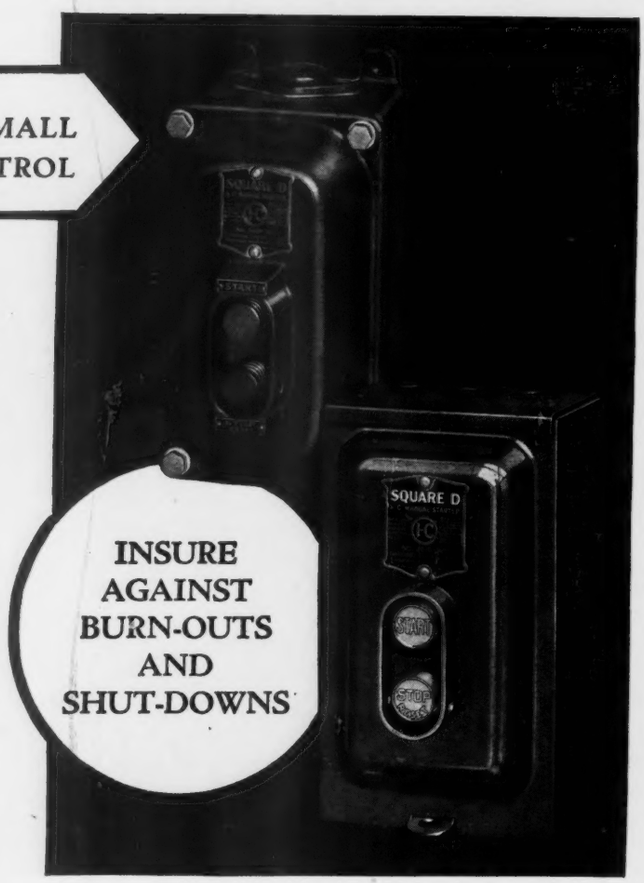
FIRST.... PROTECT YOUR SMALL MOTORS WITH PUSH BUTTON CONTROL

NOW is the time to begin putting your plant in order—to renovate and bring it up-to-date. If the maintenance budget won't permit large expenditures—make a start by equipping your small motors with push button control and overload protection.

A lot of replacement starters can be bought for a few hundred dollars. That part of the job will be done and you will have insurance against burn-outs and shut-downs—as business improves and production mounts.

Push button control—either manual or automatic—and overload protection for all motors are essential for the modernly equipped industrial plant. The economies are proved.

The Class 2510 A. C. Manual Starters are suitable for squirrel cage motors up to 5 H. P., 220 V. or 7½ H. P., 440-550 V. They provide push button control and overload protection by I-C thermal relays. The low cost will surprise you.



ABOVE is the Class 2510 Starter with cast iron, dust-tight and water-tight enclosure.

Below is the same starter with standard sheet steel cabinet.

NRA MEMBER U.S. WE DO OUR PART

SQUARE D ELECTRICAL EQUIPMENT I-C SQUARE D COMPANY INDUSTRIAL CONTROLLER DIVISION MILWAUKEE, WISCONSIN, U. S. A.

SQUARE D COMPANY

INDUSTRIAL CONTROLLER DIVISION
MILWAUKEE, WISCONSIN, U. S. A.

BRANCH SALES OFFICES IN ALL PRINCIPAL CITIES